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THE POONA
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Vol. IX.] JULY 1917. [No. 1.

Editorial.

ON entering in a new volume of this magazine it is surely not irrelevant to recapitulate in a few words the aims of a publication of this character and the purposes we had in view when nine years ago we presented it to the public, for the first time.

This magazine is mainly one of agricultural propaganda. The main reason for its existence is that it is to the people the carrier of the gospel of a better agriculture, that it is a means of dispersal of knowledge among the population, of that knowledge which comes from science and practice put together, of speculation and experiment combined. For this purpose, in each volume of our publication we try to gather and offer for public consumption the fruits of experience of those who have taken to heart the development of the agriculture of this country.

There are many investigators working in our country for that purpose. There are those whom the government employs and whose sole function is to find out for the people the best, the most efficient and the cheapest methods of culture ; and there are those who work privately, out of mere love for agricultural and scientific matters, without any further encouragement than which comes from within themselves, from the satisfaction of having accomplished a good purpose. We prize the latter type of workers even more highly and it is to them that this magazine very largely belongs. Government have their own organs of publication. Our private workers whose experience and knowledge is worth lacs of rupees have much fewer facilities.

It gives us very great pleasure to note that a very large number of those who labour unseen for the benefit of improved agriculture in India are men who have acquired the foundations of their knowledge and have learnt methods of work at the Agricultural College at Poona. This magazine thus becomes a link between the past students and their *alma mater*. It thus becomes the connecting link between those many enterprising young men whom this college prepares for life every year and their less fortunate colleagues—few in number—who are not endowed with that spirit and are content to work their way in life either living upon their acres with as vacant and unintelligent a mind as when they joined the college or as workers in other branches of human activity than those for which they were trained at this college. To these unfortunately this magazine is a mere souvenir and nothing more. To the former it might serve, and we desire that it should serve, to guide them to more enterprise and a higher standard of work. A time may come when they will feel that they are undoing the work for which they were trained and will decide to modify their methods. This magazine then will be to them a source of knowledge and inspiration.

Every year the number of young men joining the College of Agriculture increases, yet every year we hear more and more of the hesitations of the students as to what they shall do at the conclusion of their course. By a very large number the question is asked "What are our prospects" ? "What is in store for us when we come to a successful termination of our studies"? This magazine which is intended to circulate among the population at large which includes the parents and the educators of future students of this college, gives them a suitable answer. When they see what sort of men are those who contribute to it, how those men are working, and how they have succeeded in life, they will know that it is with a man's own self that the working out of his prospects lies, that to rely upon ready-made places, often under-paid, hence causing the standard of our graduates to be undervalued, is certainly unsatisfactory to all concerned. When they study the pages of this magazine they will know that we who finish our training at this particular stage of transition of Indian Agriculture are, to quote the words of Dr. Harold H. Mann, "the missionaries of a better agriculture", "the apostles of a new era".

In a number of a Poona newspaper published sometime after our last issue came to light we read an article by a man styling himself *Landowner* in which a certain number of gross misstatements of facts are mixed up with some statements of opinion which we consider entirely wrong. They are both of a character which makes them appear to be a direct attack on an institution to which we belong and on which are centred our best affections. The article which we refer to, therefore, can hardly be allowed to pass unanswered.

The first part of the present article is a sufficient reply to a greater part of *Landowner's* remarks and to such phrases as these "They (the graduates of the Agricultural College) have been turned adrift to find employment wherever they can get it." "the proper sphere for their activities is the land revenue department."

When a man asserts about our college that "not a single graduate has started a farm of his own," we can only hope that he is merely ignorant of the facts, though to make such a statement in ignorance involves great carelessness at least. If landowner would only care to apply for information to the Principal of the Agricultural College, he would be astonished to find what a large percentage of our graduates have gone "back to the land."

A further statement of the writer whom we are discussing is "they (the graduates) are no better than matriculates." It would seem that he cannot have read a copy of the "Revised Regulations of the University of Bombay for examinations in agriculture." That programme of our work which extends for three years, if it fails at all, it certainly does not fail by defect. If, however, the writer means that those who have left the college by the unanimous consent of a body of about a dozen examiners, have passed through much as a very small fish escapes through the meshes of a very large net, he throws a slur upon that body of examiners or upon the institution which chooses them. Anybody who knows how eminent in the public life of the presidency are the gentlemen selected for setting the papers, will find landowner's statement completely unjustified.

The following statement to which the supposed failure of the agricultural graduates is, among other things, assigned is of all the gravest for it involves many other serious issues. "They (the graduates) do not belong to the caste or class which makes cultivation the means of livelihood." It is a grave assumption for it implies a principle which every enlightened man of our generation repudiates as false, the principle that certain classes of people are born to perform certain classes of work which other classes cannot and must not perform. It involves the anti-social principle that groups of men can be cut off from each other by boundaries of birth prejudices, whereas the only thing that can prevent people from mixing with one another is the difference of education. It includes the grossly false principle that agriculturists like genius are born and cannot be made. It sets up heritage as the sole determiner of success and failure in life and gives no place to the influence of training and education in the making of man.

Landowner would wish us believe that for instance, because a man' s ancestors were for three or four generations, sweepers of the streets of a town, he could not become at any moment a suitable landowner; that because a man counts three or four lawyers in his pedigree he cannot possibly manage a farm or direct the working of a dairy. We, however,who believe in the enormous influence of education, of training, of suitable direction, in the moulding of a character, are perfectly sure that all the graduates of the college if they really intend to devote their energies to the tillage of the soil, as many do and have done, will be the proper sort of men to do it, whatever their origin may be.

The parents of many of us have no connection of any kind with agriculture, but we mean to; the parents of many of us never handled a plow nor planted a seedling, but we intend to. And we have great faith that with the training we obtain at the Poona Agricultural College, supplemented by one or two years' direct experience on the land, we shall do it quite successfully.

A Cotton Survey of the Ahmedabad District.

BY

K. D. Kulkarni.

AHMEDABAD is the most northerly district of the Bombay Presidency. It may be described as a tract lying north and west of the head of the Gulf of Cambay and the main body of it is bounded on the north by the Baroda State and the Mahi-kantha Agency. On the west it stretches to the Rann of Cutch and a number of Kathiawar States. On the south lies the Bhavanagar State, and on the east the Gulf of Cambay and the Kaira district. It is, however, very much split up by sections of the various States which touch its borders.

The district is subdivided into the following talukas: —

(1) Daskroi, (2) Dholka, (3) Sanand, (4) Viramgam, (5) Dhanduka, (6) Ghoda, (7) Prantej, (8) Modasa. Leaving out of consideration the Ghoda, Prantej and Modasa talukas which differ largely in character from the remainder, the other portions of the district may be divided into seven sections each marked by a peculiarity of soil and difference of people.

(1) *Daskroi*, from the Sanskrit word *dashakroshia*, the land included within the radius of ten *kos* from the capital of the district. The soil of the tract is sandy loam.

(2) The *Sabarkatka* or country on the lower course of the river Sabarmati having an alluvial soil formed by that river.

(3) The *Bhal*, or black soil tract, comprising the southern half of the Dholka taluka and the eastern half of the Dhanduka taluka.

(4) *Nalkanta.* This extends from the banks of the Nal to the south of the town of Sanand. Its soil is mostly the so-called *besar*.

(5) The *Kanka.* This lies from Sanand northwards to the Baroda territory of Kadi and Patan. The soil is *goradu* or very fertile sandy loam.

(6) *Chuval.* This lies north of the Nalkanta—north of Viramgam. Its soil is a sandy loam.

(7) The *Kanear*--A narrow tract of reddish soil west of the *Bhal.*

The main body of the district is a flat plain, but the north-east, towards Modasa, and the northern portion of the Prantej taluka touching the Idar state, are rather hilly. Here the rock shows itself bare sometimes or the soil is scanty over the *murum* bed. The south-east of Modasa is also partly rocky. The tract is so covered with brushwood as to be impenetrable in some places.

Gradually the soil deepens southward of these two talukas and is more and more fertile. Thus the southern half of Prantej and two Daskrois with part of Dholka up to Babla and of Sanand up to Sanand is a good sandy loam and is a fertile tract. Of course the banks of the Sabarmati that are alluvial are still more fertile in Daskroi and Dholka talukas on the eastern side.

The west and south of Sanand and Dholka talukas shades off into the fertile but absolutely flat and monotonous black soil up to Viramgam whence again the Chuval tract is more sandy. The south of the Dholka taluka, and the eastern portion of Dhanduka are also of fertile black soil. The sea-shore area is salt and marshy and thus quite barren.

The Ghoga Mahal, which is considered a part of Kathiawar, is almost similar to the Deccan in its hilly nature and there are several streams flowing through it. The valleys are fertile but in places the soil is scanty and only grows grass with stunted trees.

Except in the hilly country of Modasa and north of Prantej the rainfall throughout the district has generally an average of 25 inches.

The rainy season generally begins in the end of June and is heavy in the month of July while it ends generally at the end of October. One of the reasons why there is less cultivation of cotton in Modasa and Prantej is that the plants are liable to become rotten owing to the heavy rain and are killed by frost in cold weather.

In the cold season the range of temperature is very great and part of the district is liable to frost every two or three years, especially the talukas Ptantej and Modasa. Hence the people are afraid of growing any cotton that gets shrivelled by frost. This year even in the first week of December the temperature went down to 38° F. in the Prantej taluka.

Irrigation.—Hathmati Canal.—The Hathmati Canal starts from Himatnagar in the Idar State, flows through the Prantej taluka taking Sonasan and Prantej on the way and meets the valley below the Bokh Reservoir—a large irrigation storage at the head of the Khari River.

Cotton is not much grown under this canal but a large area of about 3,000 acres of wheat and gram is irrigated in the rabi season.

Khari Cut—About 12 miles north-east from Ahmedabad at Raipur a canal is taken off from the Khari river, which runs past Ahmedabad, Aslali and Bareja where it meets the Khari river again. On this canal, the following irrigation tanks are situated :—

1. Chandela tank about 3 miles from Ahmedabad.
2. Vasai Reservoir about 4 miles from Aslali.

Both of these are fed by canal water for irrigation of lands commanded by them. Paddy is the only crop raised on this canal to the extent of twelve thousand acres in ordinary years. Cotton is not irrigated as paddy pays better than cotton and there is very little water available for *rabi* cultivation. Sugar-cane to the extent of about 100 acres is being grown where wells are utilised to supplement the canal waterings.

Tanks and Reservoirs.—Apart from Modasa Mahal, the whole of the Ahmedabad district is pretty flat and the rain water stagnates in the low parts of Sanand and Viramgam and overflows the area up to Nalkantha over the boundary of Dholka and Viramgam talukas. This tendency to stagnation has forced the irrigators to form small tanks on the low parts by making long earthen banks and irrigating the paddy area situated below them, the low parts being of course exposed after October for wheat cultivation. This system of cultivation has been in vogue for a long time and the irrigation department has put in order all these tanks at a great cost. Where the Baroda State borders the Ahmedabad district northwards, drainage water from it used to cause a great deal of water-logging and, to remedy the evil, some large drainage channels have been excavated in Sanand and Viramgam talukas. After these drains were completed some of the area on the borders has been exposed and does not now retain enough moisture for paddy crops, and cotton cultivation is developing in preference to *Bajri* and *Jowari*.

The idea of growing foreign cottons like Cambodia on these tanks and canals was once prevalent but as there is no water in them before the commencement of the rains, Cambodia cannot be grown as it only succeeds better than *Wagad* and *Lalio* if grown in May under irrigation. The later waterings in the *rabi* season do not show any improvement of Cambodia over *Lalio* irrigated, and hence it cannot be recommended for this tract. Besides there are some other disadvantages for Cambodia over *Lalio* as has been observed in Dholka and Prantej talukas where it was tried some eight years ago.

1. The ginning percentage of Cambodia which at first was 36% came down to 30% and thus less than that of *Wagad* that gins 33 to 34% and *Lalio* 36%.

2. The seed of Cambodia is not liked by cattle like that of *Wagad* or *Lalio*.

3. The seed does not drop through the sieves of the gins and hence some changes are required in the gins. The rate, therefore, charged for ginning Cambodia is one and half times that of *Wagad* and *Lalio*.

4. The length of Cambodia cotton which was nearly one inch in the beginning, decreased under cultivation in this tract to ⅝" and thus became inferior to *Wagad* that is ⅞" and *Lalio* ¾". Besides, Cambodia tends to become brittle in this tract.

5. The good colour of Cambodia cotton is rapidly lost.

Cultivation.—Cotton is by far the most important crop, covering more than 3,00,000 acres. The crops next in importance are *jowar* and paddy. *Bajri* and wheat come next. Among the pulses, *math* and *kulthi* are grown on a somewhat large scale while the other pulses such as *tur*, gram, *mug* and *udid* are grown on a very small scale.

As for garden crops, vegetables are grown largely in Daskroi and Dholka and a little in Modasa while there is some fruit cultivation in the Dholka taluka. Sugarcane is grown very little except on the Khari Canal supplemented by well or river irrigation. Among oil seeds, sesamum is grown in nearly 50,000 acres while castor, safflower and groundnut only cover a small area.

Method of sowing cotton.—Sowing is usually done by the two-coultered drill though in some places the seed is dibbled by hand at one and half feet apart each way, while broad casting is done in the backward tract of Modasa, north of Prantej and the Idar State. The distance between the lines is one to one and half feet and between the plants in a line from four to six inches in *herbaceum* cottons, and two to three inches in *Mathio.*

Wherever cotton is grown, *jowar*, or *bajri* and *til* are the crops rotated with it, *bajri* and *til* being preferred as a better rotation than *jowar*. *Bajri* is generally grown mixed with *mug*, *math* and *gawar*. Castor is used to fill up gaps in cotton due to white ants specially north of Ahmedabad.

Farmyard manure is the general manure and cotton is generally manured with ten to twenty cart-loads per acre according to the quantity available. In tracts where there is much rice cultivation the manure is used in part for this crop. In Viramgam taluka it is mostly burnt for want of fuel.

Varieties of Cotton.—Varieties of cotton that are grown in this district are as under :—

(1) *Wagad*, (2) *Lalio*, (3) *Mathio*.

Goghari and *Rozi* are found as a field mixture with *Wagad* and *Lalio*. Their distribution in the different talukas is as under :—

Wagad :—Viramgam taluka, half of Sanand from Sanand to Viramgam, half of Dholka from Bavla to end of Dholka, and further up to Dhandhuka in Bhal and a part of South Daskroi touching Bavla. It is suited for *besar* and black soils that are more retentive and is grown as a dry crop except in Sanand and Viramgam where it is sometimes irrigated. In other talukas it is considered to decrease in ginning percentage by irrigation. *Wagad* gins 33 to 34 %.

Lalio—North Daskroi, South Daskroi, Prantej, Daskroi to Sanand, Daskroi to Bavla and east of Dhandhuka except the Ranpur tract, and the Idar State. It is suited more for sandy loam and for early sowing, and yields heavy crops when irrigated, more than double, in fact, that obtained in the dry crop area. *Lalio* is improved in ginning percentage by nearly 2% under irrigation. As a dry crop, it gins 36%.

Mathio is grown in the Gogha Mahal and in part of Dhandhuka near Ranpur westwards and southwards from Dhandhuka for twenty miles and is sometimes irrigated, when the yield improves by nearly one and half times and ginning by nearly 2%. It is suited for light red or light black soils. *Gadario* or *Moto Mathio* is a white flowered variety of *Mathio* and gins 40 to 42%, while Mathio gins nearly 35%.

Kahanmi is another name of *Lalio* in the Dhandhuka taluka. When cotton is picked in the field from bolls, it is called *Lalio*, while when the bolls are taken home and cotton taken out there, it is called *Kahanmi*. As the cotton is liable to be mixed with pieces of bracteoles when the bolls are collected in the fields and cotton taken out at home, it is valued less than *Lalio*.

Field mixtures.—*Goghari* is found mixed with *Lalio* in the Daskroi taluka due to seed of *Lalio* sometimes coming from Palej and the Broach district. Sometimes it is mixed by merchants intentionally as the cotton gins better 38 % than *Lalio* or Broach and is whiter than *Lalio* though the yield per acre is less than that of *Lalio*.

Rozi is found mixed with *Lalio* in Daskroi and more in Dholka taluka due to the bringing of seed cotton of *Rozi* from Mehmadabad, Nadiad &c. to the Dholka and Ahmedabad gins to mix with *Lalio*. *Rozi* gins 27 to 28 %.

Mathio is found mixed in Dhandhuka taluka with *Lalio* due to the mixture of *Mathio* and *Lalio* made in the Dhandhuka and Ranpur gins. Some of it goes to Broach district, from Bhavnagar by sea to mix with Broach and the *Lalio* seed coming to Dholka from Broach has sometimes rare plants of *Mathio* in it.

Cambodia is found as a mixture in Daskroi, Dholka, Prantej, Sanand and Idar State with *Lalio*, as it was distributed in Dholka and Prantej talukas eight years ago and some of the cotton of these places comes to Ahmedabad from which the seed goes back to the above-mentioned places.

Dharwar-American is found as a mixture in the *Mathio* cotton sown in the Gogha Mahal and is called *Virmani* cotton there.

Lalio in *Wagad* and *Wagad* in *Lalio* are found in smaller or larger proportion in different talukas where these varieties are grown.

Yield per acre :—As regards yield of seed cotton, *Wagad* as a dry crop yields nearly fifty pounds more than *Lalio* while under irrigation *Lalio* yields more than *Wagad* by nearly two hundred pounds. Still as they are suited to different kinds of soils they cannot easily be interchanged.

Name of the variety.	Dry crop yield.	Ginning percentage.	Irrigated crop yield.	Ginning percentage.
	lbs.		lbs.	
Wagad	400-550	33-34	1000-1200	31-34
Lalio	350-500	36	1200-1500	38
Mathio	300-500	35	700-800	38
Moto Mathio	380-600	38	800-900	40-42

Mathio is grown as a dry crop and is rarely irrigated. The white strains of *Mathio* yield 1½ times more per acre than the yellow ones and the difference in ginning is 4 to 5 %. As a mixed crop of yellow and white flowers the yield of *Mathio* is 300-500 pounds but the pure white flowered variety will give a hundred pounds more per acre.

Description of the Varieties.—*Wagad* and *Lalio* are difficult to distinguish in the field when young. Their difference regarding the shape of leaves, branching, or height is not very exact or constant as was seen in Dholka and Viramgam. The examination of bolls and lint gives the correct idea and this difference is given in popular language below.

1. *Wagad* bolls are rounder than those of *Lalio*.

2. *Wagad* bolls are sweeter in taste and do not open when mature.

3. *Wagad* seed is bigger than that of *Lalio*.

4. *Wagad* seed is easy to remove from the lint but *Lalio* can be still more easily removed and gets quite clean without any fuzz.

5. *Wagad* cotton is duller in colour than that of *Lalio*.

6. *Wagad* ripens later than *Lalio* by one month.

7. *Wagad* ripens with less rain that is required by *Lalio*.

8. *Wagad* has longer fibre than *Lalio* and gins less by 2 %.

9. *Wagad* cotton does not change colour in the monsoon while *Lalio* does.

Similarly *Goghari* can be detected as a mixture in *Lalio* as under :—

1. *Lalio* bolls are rounder and smaller than those of *Goghari.*
2. *Lalio* bolls have a glossy, even, surface while *Goghari* bolls have got small pimples on the surface.
3. *Goghari* bolls are depressed at the apex.
4. *Lalio* cotton is duller in colour than *Goghari.*
5. *Lalio* gins less by 1 to 2% than *Goghari.*
6. *Lalio* bolls are light green in colour while *Goghari* bolls are deep green.
7. *Lalio* cotton is longer and finer than *Goghari.*
8. *Lalio* seed comes out easily from the lint while *Goghari* seed is very difficult to take out.

Origin of Varieties :— *Wagad*—This cotton has been grown in the district for centuries in the black cotton soil and it is supposed to have come from Wagad, a district lying south of Cutch.

Lalio.—This cotton is nothing but Broach *Deshi* introduced from the Broach district, and the people of the Dholka taluka say that its cultivation has increased much within the last 50 years, before which it was grown very little. It is suited more for the sandy loam tract and thus has occupied both the Daskrois and parts of Dhanduka and Dholka.

Kahanmi.—It is a different name for *Lalio* being introduced from the *kahanam* tract, that is Broach, from which it originally spread.

Mathio.—Yellow flowered *Mathio* has been grown in the heart of Kathiawar in Junagadh for a very long time. It spread to Gogha and Ranpur after the great famine of 1899, previously *Wagad* was grown in this tract. White flowered *Mathio* has come from Khandesh within the last twenty years.

Accordingly to different localities, *Lalio, Wagad,* and *Mathio* have got different names as below, with their meanings :

(a) *Lalio, Kahanmi, Gangadio, Pumadio.*

1. *Lalio* :—That which remains hanging out of the boll.
2. *Kahanmi* :—From Kahanam or Broach.

3. *Gangadio* :—From Gangad State.
4. *Pumadio* :—Soft.

(b) *Wagad*, *Dabalio*, *Kala*, *Sakalio*, and *Deshi*.

1. *Wagad* :—Has no connection with the village Wagad that is near Ranpur, but came from the south of Cutch.
2. *Dabalio* :—Cotton pressed in.
3. *Kala* :—Cotton whose bolls are picked out in the field.
4. *Sakalio* :—Bolls slightly opening.
5. *Deshi* :—Indigenous.

(c) *Mathio*, *Moto Mathio*, *Gadario*, *Kati Vilayati*, *Divalio*.

1. *Mathio* :—Leaves with lobes like those of the *Math* creeper.
2. *Moto Mathio* :—White flowered broad lobed variety of *Mathio*.
3. *Gadario* :—Wooly cotton from the word *Gadar*—a lamb.
4. *Kati Vilayati* :—Seed having a point like a thorn.
5. *Divalio* :—One that ripens about the Divali holidays.

Mathio cotton is the same as Khandesh cotton, a mixture of several varieties found in different proportions. Generally the proportion of white flowered plants is two-thirds to three-fourths according to different localities.

(*To be continued.*)

Pasteurisation of Milk in the Light of some Recent Investigations.

BY

B. S. Patel, B. Ag., N. D. D.

INTRODUCTION—That until very recently there was a good deal of opposition to Pasteurisation of milk, even among scientists, can be seen from the following extract from a publication in 1910 by the U. S. Dept. of Agriculture. " But the question as to pasteurization is not unsettled in the public mind alone; the subject is one which has caused a division of opinion also in the medical profession and in the scientific world. There are those who are in favour of it. Some oppose it under any condition; others admit that it should be resorted to under exceptional conditions." Even now ' its value is not universally accepted'.

It is a matter of common knowledge that "Pasteurization" takes its name from the experiments of Louis Pasteur in France. In his experiments to control the "disease" of wine from 1860 to 1864 he found that heating for a few moments at temperatures of from 122 to 140 degrees F. was sufficient to prevent abnormal fermentations and souring in the wine.

As applied to milk, to be as effective without any deleterious change in its subsequent use, it should mean a process of heating to 145 degrees F. and holding at that temperature for 30 minutes. That milk pasteurized in this way is free from all the serious objections against its use is the conclusion of the investigations under consideration and the following pages contain the evidence on which the conclusion was based.

References :–This paper in fact is a resumé of all the investigations reported by the Bureau of Animal Industry beginning with the year 1910. The following is the list of bulletins considered in this paper :

1. United States Department of Agriculture, Bureau of Animal Industry, Bulletin 126 (1910)

   "Bacteriology of Commercially Pasteurized and Raw Market Milk" by Ayers and Johnson, Jr.

2. do. Circular 184 (1912)

   "The Pasteurization of Milk" by Ayers

3. do. Bulletin 161 (1913)

   "A Study of the Bacteria which Survive Pasteurization" by Ayers and Johnson, Jr.

4. do. Bulletin 166 (1913)

   "Chemical Changes produced in Cows' Milk by Pasteurization" by Rupp.

5. United States Department of Agriculture, Bulletin 342 (1915)

   "The Present Status of the Pasteurization of Milk" by Ayers.

Claims for and objections to Pasteurization of Milk :—The advantages gained by pasteurization of milk are so generally accepted, even by those who oppose it on other grounds, which out-weigh the advantages in their opinion, that a mere enumeration is all that is necessary.

(1) Such disease-producing bacteria as Bacillus tuberculosis, Bacillus typhi, Bacillus diphteriæ, and the dysentery bacillus when heated at 140 degrees F. for 20 minutes or more are destroyed or at least lose their ability to produce disease.

(2) Reduction of the infantile death rate is acknowledged.

(3) The enhancing of the keeping quality of milk is evident.

Objections that would outweigh such a distinct gain and public safety must have been really dangerous That in some cases they were really so is granted by unprejudiced investigators, but this is not the fault of the principle underlying pasteurization, but the way the treatment was effected. To put in one sentence the whole controversy " high temperature pasteurization of earlier days must not be confused with low-temperature pasteurization of the present day."

The objections to pasteurization which are generally accepted as well founded may be listed as follows:—

(*a*) The putrefaction of the pasteurized milk instead of the normal souring and coagulation because of the assumed destruction of all lactic acid bacteria, even in low-temperature pasteurized milk.

(*b*) Interference with the digestibility of the pasteurized milk as compared with raw milk.

(*c*) Bacteria may increase more rapidly in pasteurized milk than in raw milk.

(*d*) The pasteurization of dirty milk, while reducing the bacterial numbers, does not destroy the toxins or other products of bacterial growth.

(*e*) Pasteurization encourages careless handling with possible re-infection.

(*f*) Pasteurization is a cloak for dirty milk and thus retards the extension of sanitary supervision.

(*g*) Unscrupulousness in marketing unmarketable milk may be encouraged.

Of these, as will be seen later, the first two are proved not to apply to low-temperature pasteurized milk ; the last three dealing with sanitary production of milk are true and should be guarded against ; while the third and fourth lose their force when it is shown that a properly pasteurized milk will behave and ferment like normal, clean, raw milk.

The detailed study of the change in the microbial flora of the milk will be taken up under the subject of the bacteriology of pasteurized milk before treatment and after. It may be stated here that the main plank in the objection to pasteurization because of apprehended putrefaction owing to absence of lactic acid organisms breaks down in the proof that not only are strains of lactic acid organisms found to resist the low temperature of 145°F. but that there is proportionally a larger percentage of acid formers present in milk pasteurized by holding it at 145°F. for 30 minutes.

Regarding the objection based on the supposed reduced digestibility of the milk the following summary of results obtained in investigating this question speaks for itself.

(1) Milk pasteurized by the holder process at 145 degrees F. for 30 minutes does not undergo any appreciable chemical change.

(2) The soluble phosphates of lime and magnesium do not become insoluble.

(3) The albumin does not coagulate at 145° F. but at 150° F. 5.75 per cent of the albumin is rendered insoluble.

(4) The time required for coagulating the casein by rennin is slightly less in milk pasteurized at temperatures up to 149° F. than it is in raw milk.

(5) The acidity as determined by titration is slightly diminished in pasteurized milk.

Mention has already been made that no slackness in supervision and its extension in the production of milk under sanitary conditions should be permitted on the ground of pasteurization. Pasteurization is an added protection for public safety and not a substitute to hide insanitary conditions.

Methods of pasteurization and their efficiency : We have already seen how a good deal of prejudice against pasteurizing can be traced to the way the milk was treated. A consideration of the methods in use and their efficiency in reducing the bacterial count as well as liability to neglect is thus necessary.

The two principal methods of pasteurization of milk are

(1) Flash or continuous Process.

(2) A. 'Holder,' 'Holding' or 'Held' Process.

B. A modification of the 'held' process, by bottling the milk and then pasteurizing it.

The flash process consists in heating rapidly to the pasteurizing temperature and then cooling quickly. In this process the milk is heated to the temperature of 160° F. or above and is exposed to this temperature for from 30 seconds to one minute only.

In the "holder" process, the milk is rapidly heated to temperatures of from 140 to 150 degrees F. and held at this temperature for approximately 30 minutes and then rapidly cooled as in the flash method.

The pasteurization in bottles direct has the advantage of eliminating any danger of reinfection, provided of course that the right kind of watertight seals and caps are used.

3

Which of these two methods is the least open to objection can be seen from the reports received to enquiries in that connection, which are summarized as follows. It was found from the replies received that the average temperature used throughout the United States with the "held" method was 145° F. and with the "flash" method 160° F. Similar reports from 219 milk plants showed that 75, or 34 per cent. used the "held" method and 144, or 66 per cent, used the "flash" method. The situation as judged from these reports may be best described as follows :—" As pasteurization is practised, the milk might have been heated from one minute at 140° F. to 30 minutes at 170° F. and it would all be known as pasteurized milk. However, milk pasteurized by the "held" process must be considered as the safer to use, since milk plants using the "holder" process only 1.3 per cent reported temperatures too low for proper pasteurization, while about 42 per cent of those using the "flash" method used temperatures too low to be effective."

Considered from every point of view, the "held" is superior to the "flash" method, when a temperature of 145 degrees F. for 30 minutes, followed by rapid cooling, is used, and is to be recommended for the following reasons:—

(1) It has been found that heating at 140° F. for 30 minutes will destroy pathogenic bacteria, but in practice 145° F. for the same length of time is to be recommended to be well above the limit of safety.

(2) Milk pasteurized in this way, not only is free from disease producing bacteria, so far as our knowledge goes, but it also contains the maximum percentage of the bacteria that cause milk to sour and only a small percentage of the peptonizers.

(3) From the chemical standpoint, no appreciable change affecting its nutritive value or digestibility is found to take place at the temperature and time recommended.

(4) The method has been shown to be considerably cheaper than the "flash" method to reach the same efficiency.

(5) It does not show any destruction of the cream line or undesirable odors often found to go along with the "flash" method.

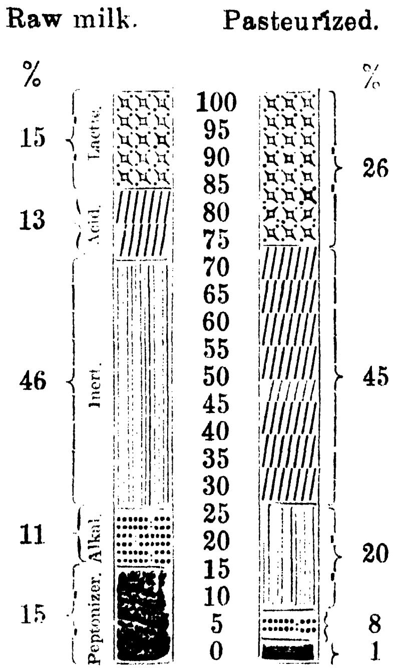
Relative proportions of bacteria in milk before and after pasteurization :-A good deal of the opposition to pasteurization of milk is due to the belief that all lactic acid bacteria are killed even at the lower temperature used in the "held" method of pasteurization, since their thermal death point was placed somewhere between 135° & 140° F and no heat-resisting strains were known and isolated until then. This complete destruction of lactic acid bacteria as assumed led to the corollary that since none of the acid forming bacteria were present, instead of normally souring and coagulating and keeping the peptonizers in check, the pasteurized milk would keep on appearing sweet while the peptonizers might be actively producing poisonous compounds and toxins by decomposing the casein and the consumer might never know of it, since the milk would not coagulate. However, as soon as the attention of the bacteriologists was turned to the question investigators reported strains of lactic acid bacteria that had a higher thermal death point than was commonly supposed and the whole controversy seems to have found its end in the conclusion that milk properly pasteurized, even under commercial conditions, soured normally and if pasteurized by the method recommended actually contains a larger percentage of lactic acid bacteria than even raw milk.

In an investigation to find the proportion or acid-formers in milk it was found that in milk heated for 30 minutes at 140° F. the percentage of acid forming organisms that survived the treatment varied from 0·001 to 18·91 per cent. averaging 4·8 per cent of the total number of colonies. At 150° F heated for the same period, the acid colonies that resisted the temperature ranged from 0·001 to 3·13 with an average of 0·74 per cent. The raising of the temperature from 140 to 150°F. thus killed nearly 85 per cent of the acid-formers that could resist 140 degrees F. The acid-formers were, of course, not all lactic acid producers, but in a later investigation it was found that the average percentage of bacteria surviving a treatment of 145° F. for 30 minutes varied according to different grades of milk treated from 1·27 to 4·55 per cent.

It has thus been definitely proved that acid development in an efficiently pasteurized milk is about the same as that in a clean raw milk and that even under commercial conditions of pasteurization the relative proportion of peptonizing, lactic acid, and inert bacteria is approximately the same in efficiently pasteurized milk as it is in clean raw milk.

Under laboratory conditions, when milk is pasteurized at 145° for 30 minutes most of the bacteria (lactic acid bacteria) left alive in it are of the kind that will cause it to sour and only a few peptonizers are present.

The hypothetical relations of the various groups and their percentages in raw milk and the same pasteurized at 145 degrees F. for 30 minutes is shown below.



A few cautions and precautions :—(1) The efficiency of pasteurization should not be based on the percentage reduction of bacteria. As a general rule when the bacterial content of raw milk is high it is an easy matter to reduce the number to the limit of required efficiency or even higher and still the pasteurized milk may contain 100,000 per cc. while good clean milk, showing a reduction of only 95 per cent on pasteurizing it, may have a bacterial count of only 10,000 per cc. In fact, when the bacterial content is low as will be the case in good milk, it is often difficult to get the required percentage reduction. One exceptional case may be mentioned here, where under exact laboratory conditions and no reinfection possible, in one sample only 17 per cent of the bacteria were destroyed on pasteurization.

The fallacy of depending on percentage reduction for efficiency of pasteurization is obvious from the above.

The best way of maintaining control of pasteurization would be by bacterial limits of the milk to be pasteurized, together with trained supervision insuring the use of proper temperatures and guarding against reinfection.

(2) In view of the fact that gas-forming organisms are found to survive pasteurization and will thus give a preliminary test for the colon organisms in the bile-lactose-fermentation tubes, a complete cultural study of the organisms suspected as belonging to the colon-group should be made before condemning the milk.

(3) In cases where an inoculation of pasteurized milk with a pure culture of lactic acid organisms is demanded as a safety measure against possible putrefaction, the same result could be as easily obtained by first adding to the milk a pure culture of heat-resisting lactic acid organisms and then pasteurizing. This will eliminate all danger of reinfection, which may accidentally occur in the first plan.

(4) The long-prevailing idea that sudden cooling is an essential part of the process of pasteurization in bringing about increased destruction of bacteria is not borne out by experiments.

(5) The chief value of rapid cooling urged lies in the fact that milk suddenly cooled does not remain at temperatures where rapid bacterial increase might occur and in the sense that it prevents increase, it may be taken as one which is effective in keeping down the bacteria which in its absence might increase.

In summarizing the conclusions of the investigations here discussed, it may be said that

(1) Pasteurization should be under the control of competent men who understand the scientific side of the process.

(2) The "held" method of pasteurization, heating the milk to 145° F. and holding there for 30 minutes, is best from the bacteriological, chemical and economic standpoint and is recommended as the safest to use.

(3) None of the serious objections raised against pasteurization hold true in the method as recommended above.

(4) The value of pasteurization of milk as a measure of public safety will be reduced in proportion to the neglect in guarding against its reinfection.

(5) The efficiency of pasteurization should not be exclusively based on percentage reduction of bacteria, regardless of the quality of milk pasteurized.

(6) Pasteurized milk should not be condemned without a complete cultural study of the organisms giving the preliminary test of the colon-group in the fermentation tubes.

The Milk Supply of the City of Broach.

BY

M. M. Desai, B. Ag.

AT a recent health exhibition held in Surat, I tried on behalf of the Agricultural Department to put some facts before the public regarding the milk supply of that city. During the course of the exhibition the Agricultural Department was approached by the Secretary of the Broach Sanitary Association, who requested that statistics regarding milk supply should be obtained for their city. The Deputy Director of Agriculture then instructed me to proceed to Broach and gather together the facts required for an understanding of the milk problem as it occurs in that city. It is the results of this enquiry which form the basis of the present paper.

The population of the town of Broach is approximately 43,000 The supply of milk is obtained from animals kept in and round the city numbering 1372 buffaloes and 613 cows. Of these about 40 per cent of the buffaloes and 50 per cent of the cows will be dry at any time, leaving 840 buffaloes and about 300 cows to be milked for the town. It would be a fair estimate that each buffalo, in the one milking used for milk supply, will yield six pounds of milk, and each cow about 3¼ pounds. This would give as the daily milk supply of the city.

5000 pounds of milk from buffaloes.
1000 pounds of milk from cows.

Total. 6000 pounds of milk.

The second milking of the animals giving about 4000 pounds of milk per day, is used for *ghee*, *mava* &c., but is not sold as milk for ordinary consumption.

If one attempts to compare the milk supply, as revealed by my inquiries, of Broach with that of Surat and Nadiad, the comparison is much to the disadvantage of Broach. In Surat a man can get good milk by paying a certain higher rate than the usual, but this is not the case in Broach. To quote an example :—in Surat if people pay 1¼ annas per seer for milk, and are permanent customers of the dealers, the milk can be relied upon to give 6.5 per cent of fat on the average. The average amount of fat in genuine buffalo milk at Surat is 7 per cent. In Broach on the other hand, genuine buffalo milk, according to my analyses, contains 8.1 per cent of fat, but the customers who are regular and who pay 1¼ annas per seer only obtain milk containing 4·4 per cent of fat on the average. In fact, I was told that the milk dealers in Broach have a prejudice against selling milk without mixing it with water. It is the custom, indeed, to put water in the pot into which the animal is milked before the milking starts. Though the supply of the town of Nadiad is not satisfactory yet it is better than that of Broach, and it is possible to get milk direct from the buffaloes and without adulteration.

The following types of milk were found in the City of Broach:—

(1) *Milk obtainable from bhatias' shops.*—The selling rate prevailing at the time of my inquiry was one anna per seer. The usual quality was low. The *bhatias* bring milk from outside villages, heat it, allow it to cool and then remove the cream which rises to the top, and sell the skim milk to customers. The price never goes below that named above and is often higher. The amount of fat in the milk as sold is on the average 2 per cent, on the basis of five samples obtained.

(2) *Milk as received by the bhatias.*—These milk traders receive their supplies from the surrounding villages about 12 noon. The evening milk is not brought to them but is usually reserved for making *ghee* &c.

(3) *Milk as received by public men in Broach.*—People of position and wealth pay a high price for their milk, and are able thus to command good milk. The average amount of fat in such milk, from an examination of ten samples was 7.3 per cent.

(4) *Milk as sold by retail dealers.*—Much of the supply of the city is bought from hawkers who go round from house to house. The selling rate of such milk is one anna per seer. The quality was very poor, compared with pure milk, but on the average, it contains 3.8 per cent of fat. The use of incorrect measures among these dealers was not uncommon.

(5) *Milk as used in tea shops.*—There are many tea shops in Broach and a very large quantity of milk is used by them. In these the milk is first heated, the cream skimmed off, and the remainder used in preparing tea. The actual milk used showed on an average of three samples, 2.6 per cent of fat.

(6) *Milk as used in boarding houses.*—There are five Hindu boarding houses in the city in which milk is also usually used in the partially skimmed condition. An average of the two samples examined gave 3.9 per cent of fat.

(7) *Milk as used in the high school hostel and hospital.*—This showed 5 per cent of fat, on an average of three samples.

To enable these figures to be compared with what they should be, I examined a number of samples of buffalo milk, taken from the animals in my presence. These gave a maximum fat percentage of 9.5, and a minimum of 6.3, with an average of 8.1. Similar tests with genuine cows milk showed 4.8 per cent of fat on the average.

The following table gives the actual details of the determination made noted above, and a few others:—

Kind of milk.	Number of samples.	Fat percentage in each sample.	Average fat percentage.
(1) From *bhatia's* shops.	5	3·1, 2·1, 2·1, 1·6, 1·2.	2·0
(2) As received by *bhatias*.	4	6·1, 5·9, 5·6, 5·5.	5·8
(3) From bungalows of leading citizens.	13	9·5, 8·5, 7·7, 7·6, 7·5, 7·1, 6.8 6·8, 6·7, 4·6, 6·5, 4·9, 4·4.	6·8
(4) From retail dealers in streets.	6	6·2, 4·6, 4·5, 3·6, 2·3, 1·5,	3·8
(5) As obtained by permanent customers of the dealers.	8	6·5, 5·4, 4·6, 4·3, 4·2, 3·5, 3·4, 3·2.	4·4
(6) From tea shops.	3	3·6, 2·2, 1·9.	2·6
(7) From boarding houses.	2	4·5, 3·3.	3·9
(8) From public institutions	3	8·5, 5·5, 1·0.	5·0
(9) Genuine buffalo milk.	6	9·5, 9·2, 8·7. 8·5, 6·4, 6·3.	8·1
(10) Genuine cows' milk.	4	5·5, 5·0, 4·6, 4·1.	4·8
(11) Genuine cow's milk at Surat dairy farm (for comparison).	22		5·4

This shows a very unsatisfactory state of affairs. The influence of the leading citizens, Government officers, or others, seems to be sufficient to secure a fair quality of milk for themselves, but apart from them there seems little security to anyone to get good milk. The question as to how the situation should be met is beset, in India, with much difficulty. The immediate imposition of laws such as are usually found in the West does not seem possible. But I think that the time has come when all dealers in milk should be licensed, and so brought under control so that their milk can at any time be tested. The inspector appointed to do this testing could also use his influence to improve the general sanitary conditions in the handling of milk.

Under such a system of testing, if milk pretends to be from a buffalo, it should contain at least 5.5 per cent of fat, if from a cow at least 3.5 per cent of fat. Sample below these limits should be considered as adulterated.

Notes on Coconuts in the Bombay Presidency.

BY

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THE Konkan is the principal coconut growing tract in the Bombay Presidency. Out of the total area of 21314 acres under this crop, 20729 are found in the Konkan, the North Kanara district claiming 11350 acres, Ratnagiri 7059, Kolaba 1124 and Thana 1064 acres. The distribution even in the districts and talukas is not even, those areas having more creeks generally possessing a larger amount of coconut growing. The cultivation is more concentrated in Karwar, Ankola, Kumta, Honawar and Yellapur in Kanara, Malwan, Vengurla, and to some extent Ratnagiri and Deogad in the Ratnagiri district. Only the Alibag taluka in the Kolaba district and the Salsette taluka in the Thana district have a serious amount of coconut growing. The following table gives the acreage return in 1916 :—

Acerage under coconut in the Konkan.

North Kanara District.		Ratnagiri District.		Kolaba District.		Thana District.	
Honawar	4472	Malwan	2939	Alibag	1119	Salsette	965
Kumta	2470	Vengurla	2316	Panwel	5	Mahim	51
Karwar	1738	Ratnagiri	693			Bassein	33
Ankola	1614	Deogad	441			Dahanu	15
Yellapur	838	Dapoli	292				
Haliyal	117	Chiplun	252				
Sirsi	81	Rajapur	125				
Siddapur	20	Sangameshwar	1				
Total...	11,350		7,059		1,124		1,064

These districts supply the wants of the Konkan and the contiguous Deccan districts and perhaps some produce is exported. It may be remembered that coconuts are more freely used for culinary purposes in the Konkan even by the poor than is expected by the people in other parts of the country. Coconut trees once supplied large quantities of jaggery. The trees are still tapped for toddy in the Kanara and Ratnagiri districts. In the Ratnagiri district alone 17,075 trees are tapped for toddy and 3200 trees for distillation purposes, equivalent to an area of 250 acres. In the North Kanara district 4705 trees are tapped for toddy and 615 for distillation. The coir is used for cordage, making mats, stuffing chairs, beds, sofas etc. The leaves are plaited and used for thatching and making *tattis*. The midribs of the small leaves make very good brooms. The timber is used for cottages

When once well established, the trees in other parts of India as Goa, Malabar, Travancore and the east and south coasts of Madras and in Ceylon are not watered. In the greater part of Ratnagiri, Kolaba and Thana districts, however, the trees are regularly watered. In Kanara and a few specially favourably situated parts in the south of the Ratnagiri district also they are not watered. It may be remembered that in the part where trees are irrigated, the average produce per tree is far higher than without it.

Coconut plants do well along the coast, creeks, in sandy soils, saline lands reclaimed from the sea and also in sweet lands. In Ceylon and the Madras Presidency large numbers of trees are found even far away from the shore. Coimbatore and Podanore in the Madras Presidency are about 70 miles from the nearest seashore and 1200 feet above the sea level; Kandy in Ceylon is above 70 miles from the coast and 1600 feet above the sea level and yet at both these places, coconuts grow very well. In our Presidency, I have seen coconuts bearing fairly well in the Town Hall garden at Kolhapur which is 82 miles from Ratnagiri and about 1850 feet above sea level. In Ceylon and at Coimbatore they get well distributed rain and no very special care is required for coconuts. In the Bombay Presidency, only in Kanara does the soil remain fairly wet throughout the year, the forest growth allowing water to penetrate from the uplands slowly, and irrigation for coconuts can be dispensed with. In other parts, coconut palms require regular watering. If for some reason a garden is neglected for some years it does not improve rapidly even if great care is bestowed upon it. Outside Bassein Fort there is a garden which is now fairly well taken care of but bears very poorly. On inquiry I was told that it was neglected for a number of years.

The coconut tree puts out about twelve spathes every year each bearing a number of small fruits. The average number of nuts actually gathered varies in different localities. In Ceylon where trees are not watered in good gardens the average is about 25 to 40 nuts (though individual trees may even bear 75 nuts) and from neglected gardens about 7 to 15 nuts per tree. In Madras where again the trees are not watered the average is better being 40 to 50 nuts per tree. In Kanara without watering the average is poor being 25 to 35 nuts per tree. In Ratnagiri district, where the trees are irrigated, the average is 50 to 60 nuts per tree. In the upper Konkan (Thana and Kolaba) where also trees are watered, the average is about equal to the yield in Ratnagiri.

The Coir Industry.—In my recent tour in the Konkan, Madras and Ceylon, I noticed that only a small part of the available husk is made into coir. In the Konkan, coconut husk is used as fuel. At Honawar, Malwan, Vengurla and here and there elsewhere, the husk is retted by some people and turned into coir for cordage. In the Madras Presidency there are a number of coir factories. In Ceylon the coir is mostly wasted. I was shown a factory near Kandy where several tons of husks, I was told, were burnt not to use the heat but simply to get rid of the material. The fibre is however springy and light and makes very good cordage and matting Coir matting keeps clean and does not harbour vermin.

The Konkan method of husking coconuts is laborious and slow; that followed in Ceylon is much better. In Ceylon they plant a strong crow bar with its but end firm in the soil and the chisel end about two feet above the ground. The chisel edge must be sharp. With this a man can husk about 1000 nuts a day. The garden coolies at Peradenya husk about 500 nuts a day in a leisurely fashion. The work requires practice and skill. They first strike the nut with both hands on the chisel head and then with a peculiar twist open the husk.

In the Konkan the husk is retted in the beds of creeks or rivers, a sandy site being preferred. After about 60 to 90 days the husk is taken out and beaten with flails, and dried and again beaten to remove dirt round the fibres. At Malwan, coir from 1000 nuts fetches about Rs. 2 to 2-8-0.

Copra Presisng.—In the Konkan the copra is pressed in the ordinary mortar and pestle oil mill (*ghani*). Recently ordinary sugarcane iron mills are used for the purpose at and near Malwan.

I saw two or three such and found that their work is more rapid and the percentage of extraction slightly better, being 62 percent against 55 to 60 by the mortar and pestle *ghani*. With this mill, (a two bullock mill), three maunds (84 lbs.) of oil were pressed in three hours. The cake was dry and clean. The owner of the mill in this case was a farmer, who crushes his cane in the season and when the cane crushing is over he presses copra for others at a charge of six to eight annas a maund. The fresh oil is used for culinary purposes, but large quantity is employed as hair oil in the Konkan and the higher country.

Copra oil can be made into nice vegetable margarin. Since there is a complaint in Bombay and large cities about the adulteration of ghee I suppose it would pay to manufacture pure coconut margarin which cannot be objected to on religious grounds and will make a good ghee substitute.

Copra cake is rich in albumnoids and is fed to milch cattle. Instead of exporting copra if it is pressed and the oil alone exported, large quantities of cake would be available for milch cattle. It would moreover open a further field of industry, and the markets would not be glutted with copra as at present, if for some reason export stops.

Coconut palms are also tapped for *mady*. 17,075 trees are tapped for *mady* in the Ratnagiri district alone besides 3200 trees more for distilleries. It pays the farmers to hire out the trees for tapping since the number is controlled. Fresh *mady* is a sweet beverage, very much like sugarcane juice. It contains 14 to 20 percent cane sugar. If it is collected always in the same pots fermentation sets in as soon as the juice is obtained, and generally even the so called fresh *mady* does not contain more than 7 percent sugar. If *mady* is kept over a day or two the sugar all but completely disappears.

The cultivation of coconuts, and even of mangoes, in the Konkan is not usually found in solid blocks. The cultivable lands in the Konkan in the first place are found in small patches. Moreover, all sites are not equally suited for coconut planting. The land must be fleshy; there must be a supply of fresh water near it: as far as possible the site must be near a creek or a shore. In Bhatkal, Honawar, Kumta, Vengurla, Malwan, Alibag and Salsette talukas, coconut cultivation is more concentrated than elsewhere, and fairly large blocks of lands are under coconuts. In other talukas, the peasants and even the non-cultivators put in a few coconut palms wherever facilities exist. In all the cities and villages along the coast coconut palms are seen in the backyards of houses.

Coconuts are always first started in a nursery before they are transferred to their permanent places. Seed nuts should be selected from a strong mature palm of good bearing strain. The nuts should carry thick and rich copra. The nuts intended for seed should be ripe on the trees and be lowered carefully and on no account thrown down. It is better to keep the seed nuts a little longer on the tree than they would otherwise be kept. When lowered early in March they should be cured till the husk is dry and the water inside is absorbed. It is better not to keep seed nuts in the sun.

The land selected for a nursery should be dug up and left in ridges and furrows. The nuts should be planted with their tops rising slantingly in the ridges and covered well, leaving only the tops above the ground. The ridges should then be well packed and watered. Nuts germinate in about three months and become ready for transplanting in about one year though many keep them in the nursery for two or even three years. One year seedlings are the best.

In the Konkan no care is taken to select seed nuts. Any nut or seedling is considered as good, and this is a serious mistake. Coconuts are not an annual crop and a mistake made cannot be rectified. It is therefore very necessary to select proper seed nuts. It is also customary in India and Ceylon to plant coconuts too thick. The people plant from seventy five to one hundred trees per acre and sometimes more. In such crowded gardens trees do not get sufficient light, air and plant food. Mr. Baba Saheb Gaolar, an experienced landlord and a good observer at Masure considers this to be a very bad practice. The agricultural officers in Ceylon say the same thing.

The best distance in blocks is twenty-six to thirty feet apart. When coconuts are to be planted on a *khar* dyke in one or two lines the distance may be reduced to from twenty-two to twenty-five feet since at least they get open spaces on two sides. The holes for planting seedlings should be three feet square and three feet deep, and should not be filled at once. The nut of the seedling should be at least a foot and a half below the surface of the ground. As the plant grows, the remainder of the hole should be filled up. Coconut palms have much surface root growth and as such roots are put out these should be covered in saline land with sweet sandy soil. The best time for planting seedlings is in August.

Plants begin to bear from the fifth to the tenth year according to the nature of soil and care bestowed upon the cultivation. Ordinarily in good plantations trees come into full bearing when twelve or thirteen years old.

The plants require watering till they become five years old. As I have already stated, in Kanara it is not the custom to irrigate coconuts after this, but I am inclined to think that even there it would pay to irrigate these. Mr. Habbu was getting only twenty-five nuts per tree from his tenants. When he sank a well, the trees began to bear better and now he gets thirty-five nuts per tree, while in the sandy soil there the well only cost him Rs. 35/–. In the North Konkan it is essential to irrigate coconut trees if any yield is to be obtained.

The regular cultivation of the land under the palms helps them considerably. The land should be ploughed and disked. When the land is under nothing but coconuts, catch crops can be taken for three or four years. Afterwards some green manure should be grown and ploughed in. Even simple ploughing helps a great deal. At Peradeniya a plot showed 52 percent increase in yield in two years by simply ploughing the land twice a year. Cultivation also economises water.

In the neighbourhood of Malwan along the coast, the people apply dry fish (about 14 lbs., to each palm) every alternate year. In Salsette taluka fresh fish (about 50 lbs. per palm) is given. In Kanara green leaves and salt are applied. In Goa one year salt and cow dung are given, and next year earth with sea mud. In addition green leaves are often added to the soil under the trees.

Along the coast, fish, oil-cakes, (*undi*, *karanj or khurasani*)· see-weed, salt, mud, and cow dung are usually available and are used.

Pests.—The well known *Rhinoceros* beetle called *bhunga* is very troublesome to coconut trees and is perhaps the most serious pest of the tree. The best way to deal with this pest is to go over young plantations regularly every morning from May to October and extract the insects with a long stiff wire carrying a barb or hook at the end. *Bars* of broken umbrellas make good probes. By practice one learns to feel the insect with the wire and it is then easily pinned and pulled out. When the insects are removed it is better to plug the hole with tar and sand.

Rats are very troublesome to coconut palms. I expect fully 20 percent of the available nuts are eaten or spoilt by rats in many a garden. As an example I may say that at Villeparle, a careful observer told me that he loses annually about a thousand nuts from a plantation of four hundred palms.

When palms are planted too thick, rats travel from tree to tree and never come down. They make their nests on the trees. To prevent the attack of rats tree shoud be planted at such a distance that their leaves will not touch each other and they should occasionally be gone over and the dirt in the axils of fronds removed and any rats killed, but the surest way of preventing the damage is to put in a smooth piece of tin round the stem. It may be made into a hood or just wrapped and nailed. The tin surface being smooth the rat cannot climb over it. The tin should cover about one foot length. The sheet had better be nailed between fifth and sixth feet from the ground. This method has been recently worked out and applied with great success in the Konkan.

Bleeding disease.—In the Konkan, Malabar and even in Ceylon this disease is observed. In the Bombay Presidency it is more common in Kanara. The tree affected with this disease first shows a crack about four to six feet from the ground from which dirty red water comes out, the liquid runs down the tree and discolours the tree. The disease is supposed to work its way up. It is found in sandy and saline soils. Trees however go on bearing a long time even though they may be affected. In Kanara and even in Ratnagiri people bore a hole about two inches square right across the tree a little above the spot oozing discoloured liquid. Many people told me that when this procedure is adopted the disease does not spread upward.

Bud rot.—In the Madras Presidency the mycologist showed me a fungus disease which produces discoloured spots on the leaves and gradually works towards the centre and turns the central leaf pale yellow before it expands. The leaf dries and drops. Subsequently the next one outside it hangs and dries and eventually the tree dies. A similar disease was spoken of in Ceylon but it was not considered serious. But in Madras, it is serious.

Approximate cost and receipts per acre.

A. Where plants must be permanently irrigated.

Expenditure.		*Receipts.*
Initial cost		
Pits and Planting	Rs. 15.	
Seedlings	,, 20	
Total Rs....	35	

1st to 5th year (5 years)

Watering etc. (one man all the time or say Rs. 50 per 100 trees)	Rs. 150
Manure, earthing etc.	,, 60
Assessment	,, 35
Total Rs....	245

6th to 10th year (5 years)

(The plantation being watered regularly every alternate day.)

Watering	Rs 400	60 trees @ 12 nuts	
Manuring, watering &c.	,, 60	on an average	Rs. 180
Assessment	,, 35	Leaves etc.	,, 30
		Total Rs....	210

From 10th year onwards per annum.

Watering	Rs. 80	60 trees @ 60	
Manure etc.	,, 10	nuts	Rs. 150
Assessment	,, 7	Leaves, coir etc.	,, 12
Total Rs....	97	Total Rs....	162

After six or seven years a coconut grower should make Rs. 65 per acre or about one rupee per tree net profit.

(B) Where there is no irrigation after the sixth year.

Expenditure.		*Receipts.*	
6th to 10th year.			
Manuring, earthing etc.	Rs. 60	60 trees @ 8 nuts	Rs. 96
Assessment	,, 35	Leaves etc.	,, 20
Total Rs....	95	Total Rs....	116

From 10th year onwards per annum.

Manure etc.	Rs. 10	60 trees @ 25 nuts	Rs. 60
Assessment	,, 7	Leaves, coir etc.	,, 5
Total Rs....	17	Total Rs....	65

In this case there should be a net profit of Rs. 48 per acre per annum, or about 12 annas per tree.

Variations in the Quality of Farming in the Charotar.

BY

S. N. Patel.

THE Charotar, a tract of land of very great agricultural importance in Gujarat, lies between the rivers Sabarmati and Mahi, and comprises three talukas of the Kaira district as well as a few Baroda villages. It is renowned, throughout western India at any rate, as an area of intense cultivation on the one hand, while it maintains one of the finest of Indian breeds of cattle for draught and of buffaloes for milking purposes.

The word Charotar is derived form a Sanskrit word meaning 'beautiful Soil'. The nature of this soil is usually light,—and varies from a typical gardening loam to a light sandy soil,—and as a whole it is termed *goradu*. Its general adaptability is shown by the large variety of valuable crops grown upon it,—cereals, legumes, garden crops, vegetables, fruit trees, tobacco &c. Of these the most profitable are tobacco, *jiru* (*Cuminum cyminum*) and *variyali* (aniseed) but the two last are delicate and much subject to mildew. The district is covered with many trees,—in this respect a great contrast to the black cotton soil areas further to the south-and their presence generally means a deep rich soil and an ample water supply.

The *Charotar* is, moreover, a good grass country, and the higher lands have many grasses (locally known as *zinzao*, *droya*, and *ghandhi*) which remain green throughout the cold weather if only favoured by rains in the latter part of the year. These are always saleable at a good price, and the first two are reckoned the very best in the country. They are commonly found evergreen near the water channels on the irrigated lands.

Another feature of the *Charotar* is the presence of living fences, impenetrable to cattle, round most of the fields, and consisting of cactus, interwoven with thorny creepers. These require no attention except an annual pruning in the month of June. This fenced condition is most unique in India, but has a considerable influence in raising the standard of agriculture in the district. The fences protect crops from cattle damage, one of the banes of Indian Agriculture, act as windbreaks and shelters, thus allowing the sun-curing of tobacco to take place in the fields in which it is grown, and prevent, partially at any rate, the washing of the land and the blowing about of the soil, so obvious with the light soil in unfenced areas of the neighbourhood.

The *Charotar* had the reputation previous to 1896, of being safe from famine, and the rainfall to be exceedingly reliable. Since 1896, however, this appears to have become less certain, and moreover the district has been affected by other calamities, namely serious visitations of plague and cholera. Much of the *Charotar* is in the Kaira district and the following extract from the census report of 1911 indicates something of the effect of the recent conditions among the people. " Kaira, with a density of 433, although showing a drop of 13 per square mile on the figure of 1901, *due to the famine and three plague epidemics which accounted for over 73,000 people*, is still the most crowded district in the Presidency. *Charotar* supports a population of 660 to the square mile, while the rest of the district has a density of 360. The district has suffered much from famine and plague. The density of Kaira is due to the extraordinary fertility of the *Charotar* tract."

Some of the features in the agriculture of the *Charotar* tract may now be considered.

So far as irrigation is concerned, the district possesses no canals, but is full of wells. Most of these are old, deep, massively built and hence expensive,—but are so numerous as very often to be within a stone's throw of one another. The number of the wells in the district is 10986*, or in other words, *there is one well for every sixty seven acres in the whole district*.† Such wells cost, on the average, from Rs. 2500 to Rs. 3000 each, but are much less used than formerly. This is commonly attributed to the poverty resulting from the disasters of the last twenty years, and to the dearth of labour in the district, but how far this is true I am not preparad to say. The water of the wells differs considerably in quality. All contain some salts, but there is always a risk in digging a well that water too salt for irrigation may be tapped. Occasionally a water containing much nitrates is obtained, and, of course forms a most valuable source of manure. The average depth of the water is from forty five to fifty feet, though in some villages especially in Od and Umreth the water level will be as far as sixty feet below the surface.

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* Statistical Atlas of Bombay 1906.

† Bulletin 74 Bombay Department of Agriculture (1915).

Unlike the rest of the *Charotar*, there is a group of ten villages at one corner of the district, known by the name of *das-koshi* where the soil is medium black cotton soil three to four feet deep, where canal irrigation is provided, and where some of the finest and most scented varieties of rice are grown, known as *pan-khusal, kamod* and *zini*,—and where likewise large quantities of wheat and gram are grown. The rice growing in this small tract is exceptionally good.

Another feature of the agriculture in the area we are considering is the extreme subdivision of the land, and there are few landholders who possess more than ten acres of land in one lot. This subdivision and fragmentation of the land is an evil prevailing over a large part of western India, but it is intensified in *Charotar* by the largeness of the population, and its almost complete dependence on agriculture. It tends to a general deterioration of the cultivation and hence of the condition of the people.

In the *Charotar* the land is usually owned, as elsewhere, partly by genuine landlords who do not cultivate, partly by business men who have bought land, partly by genuine cultivators, and partly by those who are essentially labourers. So far as the genuine landlords are concerned, they are tending to become more and more divorced from cultivation. They hold their land from their fathers, and considering cultivation beneath their dignity, simply let out their land to tenants. These include the so-called '*khatedars*' patidars of high birth such as *Desais*, *Amins* and the like. Land belonging to such holders tends to deteriorate rapidly as the tenants have no permanent interest in it. The same remarks might be made with regard to land owned by successful business men.

The cultivators proper, the largest class of landholders, of course, are chiefly *lewa-patidars*, *kunbis*, *dharalas* and other similar castes. Education has hitherto made little progress among these people, and the question of finance is a continual trouble.

So far as the labouring classes are concerned, whose holding is land is usually very small, their financial condition has improved much in recent years. Among the coolie class (*dharalas* chiefly in the *Charotar*) the ravages of plague and famine as well as other causes have led to very considerable rise in wages. Education has however progressed little among them, and there has, by common consent, been very little, if any, increase in the efficiency of the labour.

There are a number of types of land tenure in the *Charotar*. By far the most common is the *narwa* tenure, under which the majority of the villages are held. Its peculiarity is that it involves joint responsibility for the payment of Government revenue. The lands of *narwa* villages consist of certain main divisions (*muksh-bhag*) containing subshares (*peta-bhag*). The head of each main division is called a *muksa-bhagdar*, and is responsible for the payment of Government dues, or the assessment leviable on the whole share. Similarlv the headman of each of the subshares (*peta-bhagdar*) is responsible for the collection of the revenue from his subshare. All subsharers have equal rights, are called *patidars*, and are the descendants of old proprietary cultivators. The peculiarity of this tenure lies in the fact that the land cannot be sold to an outsider, other than the *muksh* or *peta-bhagdar*, nor can it be resumed by Government if dues are not paid. The distribution of land under this tenure is very unsatisfactory and hinders the development of economic and profitable farming.

Other tenures are as follows:—

Udhad Jama tenure.—The land held under this tenure is not subject to increased assessment and is liable to a fixed cess (*jama*) only. This remains even when the assessments are generally revised. There are very few villages under this tenure in the *Charotar*.

Wanta tenure.—In this case the land is owned by talukdars free of assessment. In the majority of cases a quit rent (*judi*) is however imposed by the paramount power.

Mehwashi tenure.—This is really the *udhad jama* tenure in the Mahi valley. There are villages on the banks of the Mahi river in the Kaira district which are known as *mehwashi* villages, and are inhabited by *mehwashi kolis* and Rajput chiefs. The principal share holders are termed *thakors* and the subshare holders are known as *bhayatas*.

Inam or privileged tenure.—The lands held under this tenure are chiefly *chakariyat* that is to say held for service, or *pasayata*, that is to say given for charity. All the latter are now held under special *sanads*, under the summary settlement act.

The permanent improvement of the land held by the cultivators of the *Charotar* in recent years has not been very great. The Deccan agriculturists' Relief Act has made the obtaining of capital for such improvement much more difficult, as the difficulties of recovery are so great that *sawkars* will not advance money to anything like the same extent as formerly. The chief improvements recently effected have been the deepening of wells by boring resulting in many cases in considerable increase in the water supply, and the putting up of oil-engines, chiefly for pumping water. Of these latter at least one hundred have been put up during the last few years.

The dairying industry has developed enormously in recent years, in spite of all the difficulties already existing and of the regular drainage of good cattle to Bombay, until it now is the most concentrated area of milk production in the country.

Buffalo-keeping has been looked upon by the cultivators as a secondary source of income for a very long time. A cultivator generally keeps from three to five animals and sells the milk to the nearest separating stations, which number from two hundred to two hundred and fifty in this area. These stations, equipped with separators, form a regular network along the railway lines from Nadiad to Baroda, and from Anand to Nar on the Cambay line. The following figures for one month's output sent from three stations, which I personally obtained in 1915 give an idea of the amount of milk products despatched by rail.

Name of the Railway Station	Milk or curds lbs.	Cream in lbs.	Mava in lbs.	Butter in lbs.
1. Uttarsanda ...	65640	8940	Nil	Nil
2. Boriavi ...	2920	60190	19600	Nil
3. Nadiad ...	82960	43720	20844	1920
Total......	151520	112850	40444	1920

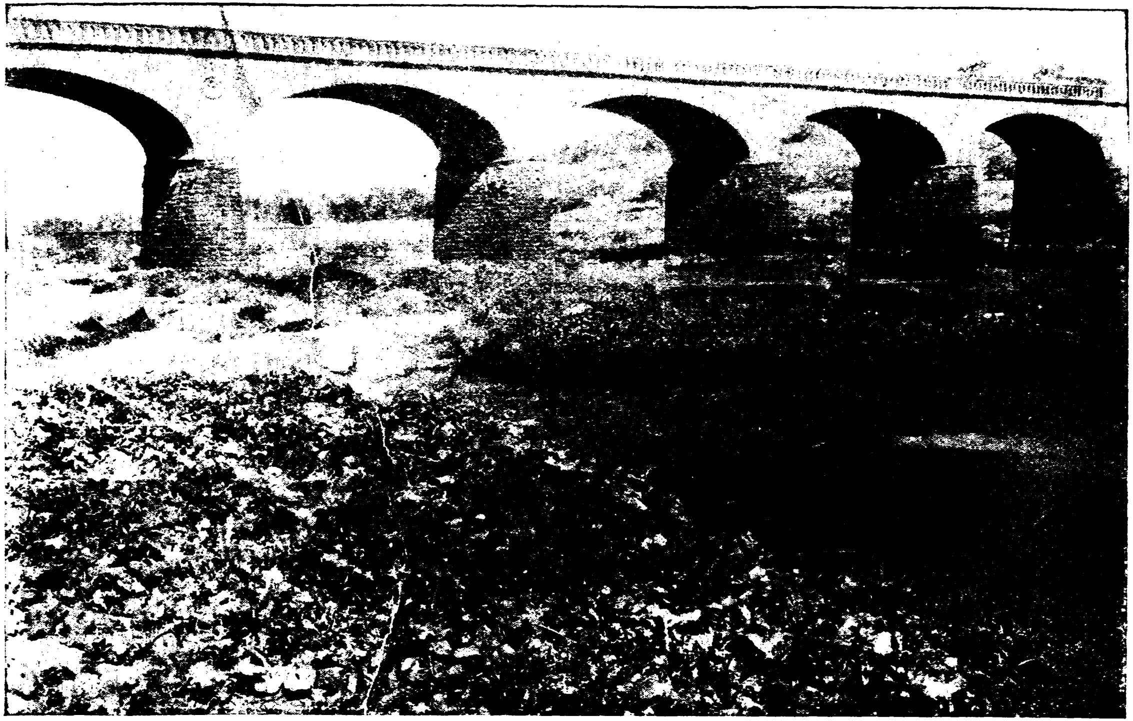
As a rule the milk and cream were sent to Bombay or Ahmedabad, the *mava* to Bombay or Surat, and the butter to Howrah chiefly.

Notes on Eri Silk in Ratnagiri.

BY

T. R. Kotwal, B. A. LL. B.

I take the liberty of bringing to your notice a few facts relating to my private work about eri silk worms. In October 1916, I successfully reared these silk worms on the leaves of Shivan (शिवण) (*Gmelina arborea*) a big tree plentiful in this district. In December 1916, January 1917, I reared again the same kind of worms fed on the leaves of *Pandhara Chafa* (पांढरा चाफा) (*Plumeria acutifolia*). In February and March 1917 I again reared the same kind of worms on the *Vada* (वड) (*Ficus Bengalensis*) leaves. The first took about thirty days; the second and third about twenty five days. The cocoons are in appearance somewhat inferior to those from castor leaves. These three substitutes may be made known widely and they may have economic value or at any rate would help students in rearing eri silk worms in all places, even where caster is not available. It is difficult to obtain castor leaves but *Pandhara chafa* and *vada* leaves can be obtained anywhere and everywhere. Every school boy can produce cocoons if the system is tried in over a large part of India. This will stimulate production on a large scale. I reared these worms on the *chafa* and *vada* leaves in 1911 before, and again here. In the Bulletin on the subject issued from Pusa these substitutes of castor leaves are not mentioned. That is one reason why I have written this note.



Vegetables growing in the river-bed near the Bunds, Poona.

Vegetables in the Beds of the Mula-Mutha River

BY

W. Burns, D. SC. and P. J. Dhunbhura, B. Ag.

Vegetable gardening is one of the most important sides of horticulture, and there are few things in which the returns are quicker and the results more sure. In almost all parts of the Bombay Presidency the extent to which vegetable gardening is practised is determined by the amount of water available. As a rule vegetables require more water than is supplied by the normal rainfall which extends over a very short period, consequently irrigation is a necessity and a general practice.

There are certain regions however which are so well adapted by nature for vegetable growing that a short account of them and the methods adopted there may be useful to those who are interested in the subject and who may have such favoured spots in their districts commanding a good market.

Lie of the Land:—There are two natural factors which determine the location of garden patches; namely the kind of soil, and an easy and ample supply of water. These are both found often in the beds of rivers during the dry season, as for instance in the bed of the Mula-Mutha near Poona.

Soil formation.—A very interesting succulent weed, *Cryptocoryne retrospiralis* grows on the little sand that is drifted by water and deposited in safe places in the river bed protected by rocks. This weed along with two others of the same habit, -*Polygonum glabrum*, and *Cyperus rotundus*—continually grows on the same spot, propagates itself by suckers and thus catches and binds more and more silt at every inundation and thus forms soil to a depth of about two feet. The way in which a nucleus of some sand and gravel ultimately develops into cultivable patches gives an idea of how unceasingly nature works from day to day and hour to hour while man waits and watches. Patches as big as one acre are thus formed here and there on both sides of the main current. Again small islands of varying size crop up right in the centre of the main current. Patches thus formed are certainly almost ideal grounds for vegetable gardening. The soil is quite poor being composed of sand and gravel, but provides perfect drainage. It is all sand and gravel formed partly from the rock "*in situ*" and partly from the washings.

These pieces of land are the property of Government, are put to auction every year, and are given to the highest bidder. The accompanying plate gives an idea of the lie of the land.

Cultivation.—A class of people called "*malis*" bid for such pieces of land, and the same family usually works the land from year to year. Excellent examples of this kind of cultivation can be seen at Dapodi a village near Kirkee, or near the Lunatic asylum, Yeravda, or at the Bund bridge, Poona. All these places are very near Poona.

As soon as the monsoon is over and the water level sinks, the weeds are dug out with a spade, though a border of weeds is kept about a foot broad round about the plot, to protect the soil from being washed every next season. These operations are begun at the end of October or the beginning of November. The land is deeply and carefully dug, all weeds removed and the surface hoed over with a spade. The surface soil thus presents a perfectly even face, ready to receive seeds. It should be remembered that all operations are done by hand.

Soon after, the land is opened (end of November) into furrows and ridges three feet apart, and on the top of the ridges seeds are sown. About the middle of January, the sowing of the various crops to be grown takes place, the plants being put in at a distance of eighteen inches from plant to plant. More than one kind of seed is put in one place and thus a mixture of vegetables is grown giving yields at different periods. The chief crops produced are :—

(1) Cucumber, *Cucumis sativus.*

(2) *Guvar, Cyamopsis psoralioides.*

(3) *Chavli-Vigna catiang.*

(4) Gourd (*Dudeia*) *Lagenaria vulgaris.*

(5) Water melons—*Citrullus vulgaris.*

(6) Tomato—*Lycopersicum esculentum.*

They generally occur in one of the following mixtures:—

(1) Cucumber, *guvar* and *charli*.

(2) Cucumber and tomatoes.

(3) *Dudhia*, *Guvar* and *Chavli*.

(4) Water melons, tomatoes and *guvar*.

In the mixture the chief point observed is that of keeping the ground quite covered, thus checking the growth of weeds which are very prevalent in the soil. One creeper and one erect growing plant are thus selected. Besides, cucumber, *dudhia* and water melon thrive best by the riverside with plenty of moisture at the roots.

Manure.—The soil, being very light, responds quickly to the use of bulky manures. The greater the amount of manure the more the soil responds on account of the constant supply of moisture at the roots. Poudrette is the only manure that is used in these vegetable plots. It is a very rich and heavy manure and gives excellent results in presence of abundance of water. Besides the soil being light the physical condition is not spoiled by a very heavy dressing.

The first dose is given (on the 8th of January) just before opening the furrows. The second is given as a top dressing just when the seedlings are a fortnight old. The third is given eight days after the second, and the fourth and the last dose is given a week later. All the manure is given before the flowers appear. Manure is given at the rate of thirty cartloads per acre. Half of it is applied before sowing and the rest in the three succeeding doses.

Irrigation.—In the present case no irrigation is required as the patches of land are so situated as to command water by capillarity all throughout the season. Most of the patches are protected from several sides by jutting rocks, but one of the sides faces the main current. In the monsoon these patches are submerged under water; as soon as the water recedes they are exposed, water stagnates in these low-lying places a foot or more below the surface soil and remains there till summer. The water level is more or less in line with that in the main current and water rises up by capillarity keeping the soil moist at the root zone. Some of the patches are right in the midst of the river and look like small floating islands of vegetables. So these patches are full of moisture all the time, the furrows are always seen moist and the ridges being a foot higher than the level of the bed always remain dry. Water thus reaches the root by capillarity while the presence of constant water makes it possible to manure heavily with such a strong manure as poudrette.

This system involves no cost for watering and is thus more profitable than the general system of growing vegetables on canal or well water. The work of sowing, repairing beds and watching is done by the *mali* and his family and a good deal of money is spent in eradicating weeds. The cost of manure (poudrette) is from Rs. 1-8-0 to Rs. 2/- per cart, including carting. A labourer costs from six to eight annas per day.

The vegetables are marketed wholesale to merchants from Bombay, through brokers, in the hot months of April, May and June.

Epilachna Beetles as a Pest on Cucurbits.

BY

H. B. Kulkarni, B. Ag.,

District Agricultural Overseer, Gadag.

AMONG the many pests which attack cucurbits, the Epilachna beetles, belonging to the family *Coccinellidae*, and technically known as Epilachna 28 *punctata* are among the most serious. They feed upon the leaves of cucurbit creepers both in the larval and adult stages. The adults eat the epidermis but their share of the work of destruction is comparatively small. The larva also feed upon the epidermis of the leaf. They are voracious feeders and seriously interfere with the healthy life of the plants if they are not checked in the early stage of the attack. At that time, hand picking may prove effective. But, later, an insecticide will be necessary.

The life history runs as below. Eggs numbering 75 to 125 are laid in clusters on their ends generally on the lower side of the leaf. They are oval in shape and very pointed at both the apices. They measure one twentieth to one twenty-fifth of an inch and have a pale yellow colour.

Four or five days after the eggs are laid, tiny young larvae hatch out in a mass. After about an hour or so they separate themselves and move about in search of food. They are oval in shape with a flat ventral surface and a curved dorsal one. The whole body has a prevailing yellow colour appearing very bright just after the insect has hatched or moulted. As the larva begins feeding, the alimentary canal can be seen like a black line in the abdomen. What makes the larva very conspicuous is the presence of six lines of branched spiny processes two in the centre of the back and two on each side. The spiny processes consist of a main spine with some axillary ones. The main spine is quite erect. It has rather a yellowish colour at the base and a deep black colour at the top. The side spines form an acute angle with the main spine. The lower ones are rather yellowish while the upper ones are jet black. They are also very pointed. Their number varies from six to ten. After moulting for the first times all the spiny processes present a transparent yellow colour. Each segment of the body contains six such processes. There are four more on the head in continuation of the line on the back and those on the sides. The processes on the head contain the greatest number of axillary spines which rise with very short interspaces. As I have already remarked it is the presence of these spiny processes which gives its peculiar appearance to the larva and makes it very conspicuous, and more conspicuous as it gets older.

The larva possesses three pairs of legs. It goes on feeding and growing bigger in size every day. After three or four days it becomes inactive and moults from the head first and then from the remaining part of the body. After moulting it becomes very active in search of food. In all it has five moults at short intervals when ample food is offered and at longer intervals when this is scanty. All the life stages can be seen on the leaves of cucurbit creepers. In all the life history occupies four or five weeks. After the last moult the larva pupates and the adult beetle emerges after about a week.

A Short Note on Artificial Coffee.

BY

V. A. Tamhane, B. Sc., L. Ag.

RECENTLY a number of samples were received in the Laboratory of the Agricultural Chemist Bombay, Poona, under the names of 'artificial coffee' , 'swadeshi coffee', 'coffee substitute ' &c. &c. These were sent for identification, analysis and report as to whether they were nutritious and harmless.

Microscopic examination revealed that the samples were made by roasting and crushing seed of *takla* (called *kuvadia* in Gujarati) *Cassia Tora*, a shrub which is commonly found as a weed in the field. This shrub grows to the height of one to three feet and bears thin legumes about five inches long.

The adulteration of *Cassia Tora* seed adds one more number to a long list of coffee adulterants already in practice. Chicory, roasted flour of several cereals, potato starch, ground date stones and various leathery seeds have been used to adulterate coffee.

The appearance of the roasted powder of '*Cassia tora*' seed is similar to that of ground roasted coffee, the smell however is not quite the same: it rather resembles the smell of many of the parched grains of the ordinary legumes, whereas the drink made from it, though differing in taste from true coffee is not unpleasant.

On analysing the composition was found to be as follows:-

	Roasted seed of *Cassia tora* %
Water	6·45
Ether Extract	8·25
Albuminoids.	20·00
Soluble Carbohydrates ...	49·05
Woody Fibre.	11·05
Ash.	5·20
	100·00

The ether extract contains besides oil a glucoside emodin ($C_{15}H_{10}O_5$)which is also found to be present in *Cascara sagrada*, but it is not the active principle to which the cathartic action of this drug is due. The true nature of the glucoside is not yet fully known but it is supposed to be harmless.

On comparing with true roasted coffee the artificial coffee was thus found to differ mainly in two points (I)The microscopic structure and (II) The Chemical composition.

The difference in microscopic structure is given by the following figures in which the characteristic structure has been specially marked.

FIG. I.

Roasted Takla seed.

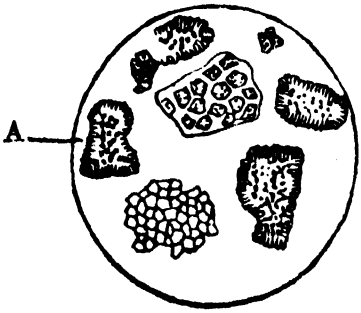
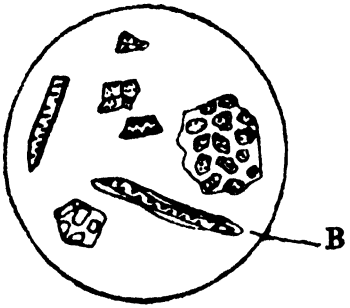


FIG. II.

Roasted Coffee bean.



A—Characteristic appearance of seed of Cassia Tora.

B— ,, ,, Coffee seed.

The chemical composition of roasted coffee is as follows:-

	Roasted coffee %
Water	3·19
Ether Extract	17·01
Albuminoids.	12·05
Soluble Carbohydrates	39.73
Woody fibre	24.27
Ash.	3.75
	100.00

The ether extract contains besides oil an alkaloid, caffein, which is the same in chemical composition as thein, the alkaloid of tea.

It will be seen by comparing the chemical compositions that the artificial coffee is richer in albuminoids and soluble carbohydrates but is poorer in ether extract than true coffee. On the whole '*Cassia tora*' may be considered as an adulterant of coffee to which on present information, serious objection cannot be taken, if adulteration is permitted at all. Whether adulteration should be permitted is another question, but the seed of *Cassia tora* does not seem to have characters likely to be seriously injurious to health.

Agricultural Competition.

Rs. 3000, CASH IN PRIZES.

(We have received the following announcement from the Chilean Nitrate Committee and we commend the same to our readers.—Eds.)

Two yearly Agricultural Competitions are instituted by the Indian Delegation of The CHILEAN NITRATE COMMITTEE, on the best essays on Indian Agriculture and original ideas how to improve it. Commencing from July 1st, 1917, closes June 1st, 1918.

1st Competition.		2nd Competition.	
1st Prize ...	Rs. 1000.	1st Prize ...	Rs. 600.
2nd ,, ...	,, 500.	2nd ,, ...	,, 300.
3rd ,, ...	,, 250.	3rd ,, ...	,, 130.
		4th (2 prizes).	,, 60 each.
		5th (10 ,,).	,, 10 ,,

This is a splendid opportunity for many to earn sufficient for a trip home or a holiday after the war, or for an Agricultural College education.

The first competition is open to all who are able to conduct experiments whether on field or garden crops, and able to read and write.

Subjects—

1st. *The present conditions of agriculture in India and in your district.*—(Deal with articles you have read on the subject and furnish clippings from papers published in India, and finally give your own ideas.)

2nd. *How can agriculture be improved in India; in you district*—(Deal with the principal crops in your district; their relation to other parts of India, if any; and irrigation, manuring, seed selection and implements.)

3rd. *Position of Co-operation, Nitrate and other manures and forestry to agriculture.*—(Deal with co-operation in relation to distribution of manures, seeds and implements, etc.; Nitrate and other manures and their essentiality to crop production and forestry, on its relation to availability of manures.)

4th. *Results of manurial experiments.*—(Deal with your own experiment, whether on garden vegetables or field crops; give details of your cultivation; time of planting, manuring, seeds used, irrigation or rainfall, harvesting and yield. Furnish as much of this information as possible in a tabulated form. Have a photograph taken if possible, of your experiment plot, and attach to your paper. Compare the cost of your manures with your other expenditure, and profit; and work out at what cost artificial manures such as Nitrate should be placed in your district to become economically profitable. What price did you receive for your crop; and if consumed by your family, how much did it help to reduce your bazar expenses?)

5th. *Summary and conclusion.*—Treat the above subjects in a concise way to show that you grasp the subjects. State how many times and in how many papers or journals you have seen our advertisements. Give names and dates of the papers. (The last information is to show that you are educated up to reading advertisements.)

RULES—

The essays should not be more than 3000 words in length, or 10 typewritten foolscap pages; and written only on one side; leaving a margin of at least one inch. If written by hand the writing should be legible. If the competitors write in the vernacular, the paper should be translated into English, and both the original and translation forwarded.

The essay should be signed with "nom de plume" (an assumed name) and a small envelope should bear the same signature. Your proper name and address should be written on a card, or your visiting card, inserted in the envelope, sealed and attached to your essay. The results of your experiments should be correctly copied as given in your essay on a separate sheet of paper and signed with your proper name. Two or three known persons should testify on this sheet that the statements made are correct. This sheet should also be inserted in the envelope ; to be sealed. The essay should reach Calcutta on or before June 1st, 1918. All expenses incurred to be borne by the competitor, except photos sent will be paid for at the rate of annas 4 and 8, depending on the size, and if satisfactory, to those not winning prizes. In addition reasonable quantities of Nitrate of Soda will be paid for by us. If permission has been obtained, the bills from the manure firms from whom the manure was bought should be sent to us (in triplicate) for payment. PLEASE NOTE THAT WE CANNOT SELL OR BUY ANYTHING; NOR EVEN QUOTE PRICES OF MATERIAL REQUIRED FOR EXPERIMENTS. WE FURTHER DO NOT RECEIVE COMPENSATION IN ANY FORM FROM ANY ONE.

JUDGES—

The Delegate of the Chilean Nitrate Committee will be one of the Judges ; the 2nd will be an Agricultural Officer ; the third a member of a manure firm. As many as possible of the Agricultural Officers and manure firms throughout India will be asked and two judges will be chosen by ballot.

The names of the competitors will not be known until all the essays have been marked, when the sealed envelopes will be broken and the owners of the "nom de plume" established ; and the results of the experiments furnished in the envelope will be compared with those in the essay. If permissions are received from the winners their names will be published in all the papers in which we advertise. Those who cannot complete their essays for this competition are always eligible for subsequent competitions.

The second competition is similar to the first except that the subjects refer only to your district and not to the whole of India as well as district. In addition, should the competitor not be able to reply to any of the three first subjects any topic on agriculture can be substituted for one of them.

Free literature, list of text-books and other information can be obtained free of charge by writing to the Director.

The Chilean Nitrate Propaganda,
1, Royal Exchange Place, CALCUTTA.

Reviews of some books in the College Library.

Notes on Some Books recently received in the Botany Section of the College Library.

B 898 House Plants, their Care and Culture ; by Hugh Findlay D. Appleton and Co., New York and London, 1916.

Pages 13 to 63 are useful to second and third year men. These pages deal with potting, watering, manures, spraying, diseases, propagation. The pictures are excellent. The rest of the book largely applies to American conditions.

B 901 The Evolution of Sex in Plants: by John Marle Coulter. University of Chicago Press, 1914.

Useful to men studying for the B. Sc. and M. Sc. degrees

B. 907 A Glossary of Botanic Terms: by B. D. Jackson. Duckworth and Co. 1916. Third Edition.

This book is useful to all classes of students and should be referred to whenever in doubt as to the meaning of a botanical term.

B 908 Experiments with Plants: by W. J. V. Osterhout. Macmillan, 1912.

A book of the greatest use to first year students. It deals with plant physiology in a clear and instructive manner and suggests numerous experiments possible for class work.

Chemistry.

C./827. Food and Fitness or Diet in relation to health by James Long.—This book is a result of a wide study of the Scientific side of the subject which the author has applied in actual practice. The question as to whether meat is an essential food is discussed by the author.

C./878. Popular Drugs their use and Abuse by Sydney Hiller —It is a good book for a general reader as it deals with the use and abuse of such substances as alcohol, tea, coffee, opium, tobacco &c., in a popular style.

C./900. Analysis of Milk and Milk Products by Henry Leffman:- The book deals with only the analytical methods which are explained in a very easy style. It is a good guide to the analysis of milk and milk products and is useful to chemistry and dairy students of senior B. Ag. class.

Mathematics and Engineering.

No. 1342. A. Practical Silo Construction by A. A. Houghton deals in detail the designing of a concrete silo and the construction of the different parts from foundations to the roof. Useful for students of intensive farming and land development.

No. 801 F. Agricultural Drawing–French and Nies.

The book can be divided into 2 parts; in the first is given the method of describing things by drawing pictures and trials of almost every kind of working drawings.

The second part deals with the design of farm buildings after a short discussion of different building materials. In this part the reader will find a method of estimating the cost of the building. Every information is profusely illustrated with drawing—Useful to all students.

No. 804 F. Hydraulics by F. C. Lea.

This book like many other books on Hydraulics deals in detail with the laws, experimentally determined of the flow of water in conduits. Hydraulic machinery such as water wheel, trubine etc. are also described along with different kinds of pumps. At the end of the book are given sammaries of researches in the subject. For students of intensive farming and land development.

No. 810. F. Modern Pumping and hydraulic Machinery by E. Butler.

Treats exhaustively and systematically the whole range of pumping appliances as well as the various machinery used in hydraulic transmission and generation of power. Describes pumping Engines different kinds of pumps and boring appliances for Artesian tube wells &c.

Useful for designing machinery and using it. Specially useful for those who are interested in the high study of the subject,

Entomology.

The Hunting Wasps—By J. Henri Fabre. Translated from French by Alexander Teixeira De Mallos, F. T. S.—Like all other books of this author it is very interesting reading. Devoid of all technical details of the Wasp's identity and its place in an Insect Museum the book leads us into the secrets of its life which is at once interesting and wonderful. After reading this book the lay reader would not fail to change his views which he must had formed of all the wasps and come to regard them better. The unimitable style which characterise the former writings is also found here and the book is uniformly interesting from beginning to end.

Report on the Great invasion of Locusts in Egypt in 1915 and Measures adopted to deal with it:—Perusal of the report shows properly organised work directed to kill the locusts in their early stages is capable of dealing with Locust invasions of the kind we have in India. The methods are none of them new: except a fews changes incidental to the differences in the environmental conditions of Egypt.

College News and Notes.

THE College reopened on the first of June and we are hard at work again. This year, as usual, a large number of fresh young men, full of earnest desire for the acquisition of knowledge have flocked over to the college from all over India. This college, thus, maintains this year its peculiar character as the trusting place for men of all types, races and creeds, but all of one mind–all resolved to make the best of their time and of the opportunities offered to them. We offer our hearty welcome to the newcomers and hope that as soon as they become better acquainted with the place and the people, they will enter fully in the activities of the college.

Government have appointed Mr. H. M. Chibber, Assistant Professor of Botany to the newly created post of second Economic Botanist. We are very sorry to lose in Mr. Chibber a teacher whose learning and abilities were of great use to the students, but we must admit that both his abilities and learning have been turned into a channel where they can be of better use to the people of the Presidency. We congratulate Mr. Chibber on his appointment and hope that in his new position he will not forget that he is bound to us by the promise of giving us a further interesting account of his experience in England.

Mr. A. M. Kazi who obtained the Diploma in Agriculture last year is an able and careful worker and his ability and spirit of observation have been duly rewarded. Mr. Kazi obtains the prize of 25 rupees for the best essay published in our two last volumes by a student, on Agriculture and allied subjects.

The present B. Ag. students find themselves in a peculiar position. They are being tried and we hope they will not be found wanting. The new course, according to the new regulations is being experimented upon them, and, if we are to judge from a few opinions which we have heard, it has taken exceedingly well. As was to be expected "Intensive Agriculture", as a special subject has a greater attraction for the future farmers than all the other subjects put together. Two men have taken "Animal Husbandry," four have chosen "Agricultural Chemistry" and one has selected "Advanced Botany." The new programme is working very smoothly, excepting, perhaps, that the Agriculturists complain of being slightly overworked in comparison to the Botanists, who have, as they say, a very easy time.

The students' union, which owes its existence to Mr. Mithuji, a past student of the college, was, we are inclined to think, in its pupal stage during last year. The torpor may, however, be accounted for by the removal of the students from former quarters for the accommodation of the wounded in the Mesopotamian campaign. Students were naturally put to great inconveniences but now they have got themselves accustomed to their surrounding and as a consequence students' union has resumed its activities this year vigorously.

A slight deviation from the usual hackneyed course of election was made in that the candidate for the secretaryship was required to put before the union a definite outline of the work he would be doing if were elected. About 8 or 10 students ventured to speak. Each had something to speak of his own. The selection was as follows :—

Ex-officio President	...Mr. D. L. Sahasrabuddhe.
Secretary	...Mr. K. V. Herlekar.
Members.	...Mr. G. C. Tambe.
	...Mr. Kabraji.
	...Mr. Jambhekar.
	...Mr. Kanhere.
	...Mr. Bhatt C. M.

We hope the secretary will be able to show good work throughout the year.

The *Marathi Vichar-Vikasini Sabha.*—Current year's session was opened by Prof. D. L. Sahasrabuddhe who delivered a lecture on "Should Religion be taught in school"? Prof. Ajrekar was in the chair. The audience was large and great interest was evinced.

The following are the office-bearers for the current year :—

Prof. D. L. Sahasrabuddhe. ...President.
Mr. G. C. Tambe ...Vice-President.
Messrs. Jambhekar and Kanhere...Secretaries.

We hope that the same interest will be shown throughout the year in the working of the society and lecturers will not be found wanting.

The Canarese students' Debating Union is not yet revived. But it is showing signs of life and it is to be hoped that the sessions will be soon commenced.

We have pleasure in reporting that Mr. R. S. Inamdar, B. Ag., who went to Combridge in 1915 as a Sir Mangaldas Nathubhai scholar to study Plant Breeding specially, has obtained second class honours in the Natural sciences Tripos Part I of the Cambridge University. This is a creditable performance considering that Mr. Inamdar did the work in two years instead of that usual three and that he had taken, General Philosophy—an entirely new subject to him—in addition to Botany and Chemistry.

Gymkhana Notes.

THE General Meeting of the Gymkhana was called on Monday, the 11th June 1917. Dr. Mann welcomed all the students and explained to the new students the spirit which underlies all our activities. He told them that we forget here all our differences and work as one body and advised all to take a keen interest in the various college activities.

Mr. Canagaratnam, the late General Secretary, being unable to be present, his report was read by one of his friends Mr. K. V. Herlekar. The adoption of the report was duly proposed and seconded with thanks to Mr. Canagaratnam and was carried unanimously.

Then the essential work of the election of office-bearers for the current year was taken in hand. Many names at first appeared on the board for each office, but at last when the option for resigning was given, many disappeared from the list. There was a lively competition throughout. The following were elected as the office-bearers for this year :—

Dr. H. H. Mann	President.
Dr. W. Burns.	Vice-Presidents.
Prof. J. B. Knight.	
Prof. D. L. Sahasrabuddhe.	
Prof. S. S. Godbole	—Chairman.
Mr. K. V. Herlekar.	—Hon. General Secretary.
Mr. H. H. Advani.	— ,, Cricket ,, ,,
Mr. N. G. Gole.	— ,, Tennis. ,, ,,
Mr. Maung K. Zan.	—Foot-ball and Hockey ,,
Mr. B. G. Vyas	— ,, Gymnasium ,,
Mr. C. Raghunathanam	— ,, Reading Room ,,
Mr. K. S. Daryani	,, Debating Society Secretaries.
Mr. C. M. Bhatt	
Mr. D. B. Bhonsale	,, Managers of the College Magazine.
Mr. M. N. Kamat	

At the first meeting of the Managing Committee, budgets for different departments were adjusted with very great difficulty, although each secretary tried his best not to get his figure curtailed in any way.

A sum of Rs. 150 has been sanctioned out of the Reserve Fund to be spent on the repairs of the new Tennis Court, and on laying a water pipe on the same.

All the departments have begun their activities in right earnest.

Debating Society

Thanks to the untiring work of its secretaries. A full programme of the lectures for one term has been already published. It will be seen from the programme (which is printed elsewhere in this magazine) that it is a very interesting one and contains all sorts of subjects. It is a noteworthy fact that they have been able to get 6 lecturers from the students It is earnestly hoped that they will not be less enthusiastic in the next term.

Cricket, Foot-Ball and Hockey.

These departments are obliged to remain rather silent on account of the fact that our play-ground has been taken over by the military authorities for their use. We are trying to obtain one, but at least one month more will be required to get it in our possession. In spite of such a great drawback the foot-ball secretary has begun his department. We hope that this year our college will make a fine team and come out victorious in the cricket shield matches.

Tennis.

One court having been set apart for repairs, only one court could be opened. The court was opened by a friendly match between the staff and the students, the success in which, as is usual every year, was on the side of the students. It seems from the daily players on the court that there are many good players among our new friends in the first year. It is fully hoped that the matches in this year's tournament may be keenly contested.

Gymnasium.

Although suffering from want of a fixed place, it is a resort of good many students in the morning as well as in the evening. There seems to be a general liking for Indian methods of exercise more than the foreign. A place for wrestling will soon be prepared for our practice in Date's bungalow.

Reading Room.

The room, being adjacent to our lecture rooms is usually thickly crowded in the recess hour, and even before the college is opened and after it is closed. A good many leading papers and periodicals are subscribed for, and we are glad to see that the students make the full use of the Reading Room.

The question of starting a boat club as a branch of our Gymkhana is being seriously considered by all the students. But we have not yet arrived at a definite conclusion. Of course it is a good and healthy recreation but costs a great deal.

1917-18.

Sessions for the first term.

N. B.—All the lectures begin at 5 P. M. **Sharp.**

	Lecturer.	Subject.	Pressident.
June.			
20th		Presidential opening address	Dr. P. D. Gune, M. A., Ph. D. (Fergusson College)
28th	Mr. K. V. Herlekar	A charge against our students	Prof. D. L. Sahasrabudhe, B. Sc., L. Ag.
July.			
3rd	Dr. W. Burns, D. Sc.	Research in Horticulture	Prof. G. B. Patwardhan, B. Sc., F. R. H. S.
10th	Mr. C. Ragunathan	Agriculture and the graduates	K. B. Bhagvat Esq. B. Ag.
17th	Prof. R. P. Patwardhan (Deccan College).	" Oxford "	Dr. H. H. Mann D. Sc.
24th	Mr. Y. T. Desai	My first impressions on Agriculture	Prof. B. K. Thakore, B. A. (Deccan College)
31st	V. K. Kogekar Esq., L, Ag.	*Cattle and cattle improvement	Rao Bahadur G. K. Kelkar
August.			
7th	M. Ezekiel Esq. B. A., B. Sc.	Parasitism—animal and social	Prof. S. L. Ajrekar, B. A. (Bombay and Cantab).
14th	Mr. M. N. Kamat	Education of Women	Prof. G. M. Chiplunkar, M. A.
21st	P. C. Patil Esq., L. Ag.	*Comparison between European and Indian Agricultural practical operations	Hon. Mr. G. F. Keatinge, I. C. S., C. I. E.
28th	Mr. Sen Gupta	Agriculture—and Bengal	Dr. H. H. Mann, D. Sc.
31st	G. S. Kulkarni Esq., L. Ag.	*Lantern lecture of Mycological and Agricultural interest	P. C. Patil Esq. L. Ag.
Sep.			
4th	Dr. H. H. Mann, D. Sc.	(To be notified hereafter)	
7th	Mr. C. M. Bhatt	Shall we join hands?	Prof. W. B. Patwardhan, B. A. (Fergusson College)

N. B.—* These will be illustrated by **Magic Lantern** slides

Vol. IX.] *OCTOBER 1917.* [No. 2.

THE
POONA AGRICULTURAL COLLEGE MAGAZINE.

AGRICULTURAL COLLEGE
AGRICULTURE THE FOE OF FAMINE
POONA

POONA:
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and published by
Dattatraya Bando Bhonsle, at the
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1917.

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THE POONA
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Vol. IX.] OCTOBER 1917. [No. 2.

EDITORIAL.

A meeting was held at this College on the 4th of August to commemorate the anniversary of that historic date when Great Britain resolved to stand against German barbarism as the defender of the small nations and two speakers referred to the enormously good work which the Agriculturists of the allied countries may do towards victory for those nations which have struck for civilisation. One of these speakers, quoting from a speech by Mr. Lloyd George, the glorious pilot who is weathering the storm, said that success for the Allies depended upon the agriculturists of the Allied Countries to as large extent as on the bayonets of the soldiers or the counsels of the politicians. For it is the party that holds the last grain of cereal that drives the other to the wall.

It may be said that the above statement is probably true of the nations which are directly bearing the brunt of the attack and that we, the Agriculturists of India have nothing else to do but to declare that we are loyal and then stand aside in a beatific attitude waiting for the end, taking for our motto those misleading words of Milton that " they also serve who only stand and wait ". For by far the majority of men, they only serve who act, and to the agriculturists, as to any other group of men, mere standing and waiting means stagnation, backwardness, the very opposite of advancement and progress.

But is it true that the Indian agriculturist may rest himself satisfied by looking indifferently at the trend of events ? Is it true that along with the work of the soldier and the work of the statesman his own small work can in no way change for the better the world's condition and help towards a speedier victory for the Allies and a lasting and balanced peace for the world ?

It may again be said that under the present conditions of restrictions on shipping the share of countries like India which are so distant from the seat of the war, in the supply of the armies is bound to be very much curtailed. But nearer to the homes of the agriculturists there is splendid work being performed, and there is much else that can be performed, by the Indian agriculturists. It is not a long time since a party of men under the leadership of a man of science and abilities was sent to the battlefield of the Indian troops to grow vegetables for these and the European soldiers fighting by their side, on the sterile sands of Mesopotamia. The men who are doing this work under conditions of the greatest hardships are Indian and the principles which they are putting into practice were learnt by them in Indian fields, upon the Indian soils. That is at least one of many ways in which the cultivators of India can give their support to the noble cause of the Allies and the fact is very suggestive.

Suggestive likewise are the lessons which the attitude of the English and French agriculturists provide at this critical time. Mr. Lloyd George assures us that in less than a year Great Britain will be self-supporting in the matter of the staple food of her people. That means that in less than a year Great Britain will change her enormously large acreage left unproductive for the pleasure and the pastime of the lords of the land into good, arable, fertile, productive soil; it means that England will in a few months cease to import food, will no more be dependent upon her dependencies in this matter, and will give its deathblow to the policy of submarinism.

Does not this fact bring to the mind of the Indian agriculturists, at least those of them who are educated in our Colleges, and of those industrial workers who are directly dependent on the produce of the land, our enormous possibilities, which are neglected of rendering our country independent and self-sufficient in many respects?

We hope this matter will deserve a few thoughts from our readers specially those who, trained at the Agricultural Colleges, are expected to be the leaders of the uneducated and relatively ignorant cultivators.

Co-operative organisation of the milk supply of cities from outside villages.*

BY

Harold H. Mann, D. Sc.

DURING the last few years a very great deal of information has been gathered as to the milk supply of cities in various parts of the country and more particularly in Western India and from these inquiries several conclusions which are of absolutely general character can be drawn. In the first place the supply of milk to Indian cities is almost universally very dear and also very inferior in quality. In the second it is usually, if not always, very deficient. In most cases while a large proportion of the milk is produced in the city itself by professional *gaolis*, a considerable amount,–sometimes the largest amount,–is brought in from outside villages daily, the attraction being the very high price which is obtainable in the city.

Such outside supply is limited in almost every case to the distance which it is possible to bring it in daily by hand. In inquiries made in Poona in 1912 it was found that at that city 21 per cent of the outside milk came from sources within three miles of the city, 69·3 per cent from those within six miles of the town, while 97·8 per cent came from places less than nine miles away. Whatever came from a greater distance than this was brought in by train. I presume that something similar to this prevails elsewhere. There is absolutely no organisation of the supply. Nearly all is brought in by hand and at first sight the matter seems eminently one in which co-operative organisation can come in at least to arrange, either on behalf of the producers or the consumers, for the conveyance of the milk by a cheaper, safer, and cleaner method to the consumers in the city. If this could be managed it would mean the improvement of the quality of the city milk, and would bring it to the doors of the people at a cheaper rate.

Beyond the area from which milk can be taken to the cities in this manner, milk is usually very cheap. I have been investigating during the present year the price at which milk could be obtained at a depot we proposed to establish at two milk-producing centres respectively twelve and fifteen miles from Poona. From these places now no milk goes to Poona at all, except in the form of its products *ghee* and *khava*. The differences in price of *pure* milk at these centres and in Poona are given below. The price at the villages in question included the delivery to the depot,—only pure milk being taken.

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* Paper presented to the Co-operative Conference Poona, September 1917.

	August to February	*March to July.*
Prices at villages 12 to 16 miles from Poona.	18 lbs. per rupee	16 lbs. per rupee
Wholesale price offered in Poona for such milk delivered.	14 lbs. per rupee	12 lbs. per rupee
Retail price for pure milk in Poona.	8 lbs. per rupee	8 lbs. per rupee

We have, therefore, two possible outside sources of milk for cities. The first is from the villages within eight or nine miles from the city and this is already utilised uneconomically. The second is from sources further away and is at present practically not utilised at all. We have in fact to consider the possibility of the more effective exploitation of these two sources of milk to increase the supply available for inhabitants of the town.

Here I may say that all my inquiries seem to indicate that the vital difficulty in organising milk supply from outside sources is the almost universal practice of adulterating the milk brought into the city from outside. In our inquiries in Poona over 80 per cent of the milk brought in from outside was mixed with water to a flagrant extent. In a recent inquiry as to the milk sent from a particular village near Poona and intercepted on the way, all was found to be mixed with water to a serious extent before reaching the city. I will speak later of the way in which this problem should be dealt with.

Reserving therefore for the moment the question of the purity and sanitary character of the milk, let us see how far we have experience of the application of co-operation to dealing with the question of organising the supply of village milk in the towns. There are, according to the information supplied by the Registrar, nine co-operative dairy societies in the Bombay Presidency. Of these most are societies for the use and benefit of city *gaolis* rather than societies for collecting milk from villages and taking it to the city. The only examples in which the society definitely organises a village supply for a town are those at Alibag and Kothrud. The Alibag society is small, but its success certainly shows what could be done in this direction. The Kothrud society is as yet in too early a stage for examining as to what it is capable of doing.

But all the evidence here and elsewhere seems to indicate that the organisation of a milk supply from the village producers for delivery to the consumers is a matter in which co-operation can take a considerable part. In one matter I want to suggest a warning. Such a society must either be a consumers' or a producers' society, it cannot be both. It must work wholly in the interests of one class or the other, otherwise there will be clashing in the work, and the society will cease to command the confidence of either section of its members. It is this fact which has brought about much of the difficulty in running co-operative dairy societies in the past.

The type of society which would seem to be best adapted to help in solving the problem of getting milk to cities in the cheapest and best form, is a purely collecting society. It would have nothing to do with production, would purchase for cash milk which is brought to a village depot and which is not *seriously* adulterated as tested in every case by lactometer and at intervals by a fat tester, and would arrange for distribution in the city. Whether this is done on behalf of the village producers or on behalf of the town consumers is perhaps of little importance. Which would work best would probably depend on each particular case, though the organisation of milk producers would probably be the simplest and most effective in the majority of the instances. In the latter case it may or may not be wise to arrange the actual final distribution to the retail customers in the first instance.

In any case I want to insist that so far as milk supply from villages is concerned, the first co-operative movement should be as organiser of the collection and conveyance of milk to the customers, be they wholesale or retail, in the city. The milk should be taken from the people in their villages and carried to the city. Milk carts can collect milk and bring it to a town centre. I am quite confident that this would be a legitimate and effective field of co-operative activity and I would go further and state that I think experience indicates that distribution is at present the one aspect of the milk problem that co-operation can tackle effectively.

It might be asked then whether I would entirely abandon the idea of a co-operative society acting as a means of improving the quality of the milk obtainable in a city. Beyond what is necessary to secure the business interest of the society, I may definitely say that I *would* abandon it. A co-operative milk supplying society is a business concern. It will take just as much care as its business requires to secure milk of the quality needed. It cannot without prejudice to its existence as a co-operative society act as a sanitary authority. The sanitary authority is the municipality and it must not be expected that a co-operative society should do more in that direction than its business interests require. Of course as time goes on, the business value of selling high quality milk would, I feel sure, appeal more and more to the members, but then it becomes a business measure pure and simple.

So far I have dealt with organising the supply of milk from villages which are already near enough to the town to send it there at present, though by uneconomical and unsatisfactory methods. To supply adequately the needs of towns, I am confident that milk will, in future, have to be drawn from wider areas, from which no milk whatever is now obtained. This matter is being realised in many places. Bombay is now or has been during the past year supplied from Gujarat and from Kirkee, not to speak of the G. I. P. Stations to Kalyan, and the B. B. & C. I. stations to Virar, by railway. Lonavla gets a daily supply by rail from Talegaon ; Poona even gets a limited quantity by rail every day. But no definite effort has been made to organise such supply in the past.

We are at present investigating matters in the case of Poona with the idea of finding out how far its supply from greater distances can be organised both by road and rail. What will be the result I can hardly say at present. But I hope that something will be done before the co-operative conference meets next year and that I shall be able to present a note on the subject there. If successful it would seem to be a matter eminently suited to the application of co-operative methods.

In the meantime, I want to insist that experience indicates that the one field of co-operative activity which seems at present to give almost a certainty of success, is the organisation of the collection of milk from village producers and distribution in the towns. Whether done on behalf of the village producers or of the town consumers it seems to have every prospect of success, though it cannot be done on behalf of both producers and consumers at the same time. I commend to you this as a field of co-operative development which offers every chance of success and avoids the dangers which have made co-operative milk and dairy societies so difficult to carry on in the past.

A cotton survey of the Ahmedabad District.

Part II.

BY

K. D. Kulkarni,

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(*The first part of the present paper appeared in July 1917.*)

OF the varieties of cotton already indicated as grown in the Ahmedabad District *wagad*, *lalio*, *kahanmi*, and *goghari* belong to the species *Gossypium herbaceum*, and similarly *mathio* cotton is classed as *Gossypium neglectum* and is subdivided into the so-called *jari* and *varadi* types according to the colour of the flowers. *Jari* plants are yellow flowered and *varadi* plants white flowered. A botanical description of each of these types is as follows:—

Gossypium herbaceum varies in height from two to seven feet. The basal branches are long and spreading, while the lateral and upper branches are also long, spreading and dropping in fruit. The older part of the branches is grey brown, slightly hairy, the young parts are green, covered with black dots and soft white spreading hairs. The sides of the branches facing south gradually turn a dark red colour.

Stipules are ovate to linear-lanceolate, falcate, about half an inch long, the broader ones sometimes lobed towards the apex.

Leaves are rather membranous, yellowish green, shallowly cordate-rotundate, palmately three to five or more-lobed, the lobes being deep ovate obtuse or acute, with margins quite entire or sinuate. The basal lobes when present are above the sinus and do not rise from it.

Inflorescence is on short secondary and tertiary axes.

Bracteoles are spreading in fruit, rounded, with about eight to ten lanceolate-acuminate teeth, reaching a quarter of the way down.

Calyx is cup-shaped, entire, accrescent and irregularly splitting with three external basal glands.

Corolla is yellow with a black eye, fading yellow, suffused with red and is half to three-fourth of an inch longer than the bracteoles.

Anthers are dark yellow with rather short filaments.

Stigmas are short, with channels straight or slightly twisted.

Capsules are three or four celled, almost spherical or ovate, pointed, shorter than the spreading bracteoles. From seven to eight seeds are contained in each cell.

Section A.—Bolls spherical with broad valves–splitting so slightly when ripe that the cotton does not emerge.

(1) *Wagad or Wagadia* and *Sakalio*—Five to six feet in height, cotton copious and silky, staple five eighths to seven eighths of an inch. Boll with a very short point but occasionally narrowed into a long one, mostly three celled, dimensions average one inch by one inch.

Section B.—Taller and more compact plants than those in Section A. Bolls narrower, more distinctly trigenous and pointed. Valves of Bracteoles not so distinctly spreading.

(1) *Lalio and Kahanmi.*—Bolls 1¼ inch by ⅞ inch, cotton fine, adhering only slightly to seed. Staple five eighths of an inch.

(2) *Goghari.*—Similar in most respects to *Wagadia* but the plants are more spreading and the bolls open out like those of *lalio.*

Gossypium neglectum.—varies in height from three to seven feet. The stem is simple and tapers gradually from base to apex. The lower branches are sparse, long and spreading, the medium are short and the upper ones are very short. The whole plant is usually nodding if well covered with fruit. The epidermis of the stem is dark brown, reddish brown upwards, black dotted and covered with white spreading hairs.

Leaves are dark green, subcoriaceous, palmate with three to five or more lobes, the lower spreading, the upper ascending. They are oblong-lanceolate or ovate-acute or rather obtuse; with sinuses broad or rising up into small extra lobes. The base is shallowly cordate.

Stipules are lanceolate-falcate, acomulate or broad ovate, are few in number and lobed at the apex.

Bracteoles are ovate-acute, quite entire towards the apex or with three to six acuminate lobes.

Corolla is a little longer than the bracteoles, pale yellow or white in colour with a dark red eye.

Calyx is cup-shaped, entire or very shortly lobed.

Filaments are long.

Bolls are ovate-pointed, three to four-celled, very distinctly dotted with black.

Cotton is usually short in staple, as well as harsh and dense all round the seed.

Section A.

(1) *Jari* type—Up to eight feet high, a few of the lower branches long and ascending; upper shorter and spreading, uppermost becoming very short. Leaves three to five lobed, lobes oblong lanceolate with rounded sinuses, base scarcely cordate, many of the smaller leaves near the stem are entire ovate or ovate lanceolate. The bracteoles ovate-acute, irregularly toothed near the apex. Corolla, yellow with a dark crimson eye, petals reflected. Bolls, mostly three celled ovate-acuminate, 1½ inch by ⅞ inch. Cotton, copious, harsh. Seeds about ten in each cell.

Section B.

(also called *Gosypium roseum.*)

(1)—*Varadi* type. This is similar to the last, but has white flowers.

Fibre Description.—The fibre from each of these varieties may be described as follows:—

Wagad cotton has long and silky fibre, seven-eighths of an inch long. It does not change colour in the monsoon. It is rather dull from the beginning and will spin yarn of 20 warp and 36 weft. It is strong and adheres very little, to the seed.

Lalio has a length of three quarters of an inch, is white, but changes colour after the monsoon. It is strong, not adhering to the seed and spins yarn of 20 warp and 36 weft.

Goghari has a length of five eighths of an inch, is very white, strong, fast adhering to the seed, and spins yarn of 20 warp and 30 weft.

Mathio (*Jari* type) has a length of five eighths of an inch, is white in colour and slightly adhering to the seed. It is rather rough and spins 16 warp and 24 weft.

Mathio (*Varadi* type) has a length of a little more than a quarter of an inch very short and woolly, closely adhering to seed and of a very white colour. It spins 8 to 10 warp and 16 weft.

Trade and mixtures.—In connection with trade and mixtures of cotton it can be said that most of the gins mix the local varieties with one another and the results are serious when different types are mixed together growing in one taluka. The centre of mixtures and the varieties mixed are given below according to information collected.

1. *Bavla*, (taluka Dholka)—*Wagad* and *lalio* are mixed together, *wagad* being valued to 10% more than *lalio*. Seed cotton of *lalio* is heaped with *wagad* and then the whole lot is ginned together. The mixture being of the same type is not very injurious either to trade or cultivation. As the ripening period of *wagad* is a month later than that of *lalio*, pure seed of each variety can be got in the gins and some merchants keep it accordingly.

2. *Dholka.*—Here '*Rozi*' and *wagad* are mixed together by bringing *rozi* cotton from the Kaira district by carts and this mixture of different types is injurious to trade, as coarse and fine cottons are mixed together and that has affected the credit of the Dholka gins in the Ahmedabad market. In the field the result is still more serious as in several villages round about Dholka, the mixture of *rozi* in *wagad* or *lalio* is more than twenty per cent and as *rozi* cotton does not yield more than 100 lbs. per acre, the mixture is a direct loss to the cultivators. Distribution of pure *wagad* seed from Bavla will probably succeed well as Bavla seed is considered the best in the whole taluka as regards purity.

3. *Ahmedabad.*—Here *wagad* and *lalio* are mixed together as in Bavla, while inferior *lalio* from Kadi and Patan is brought and mixed also. It is understood that Khandesh cotton is sometimes brought from Nandurbar, but such import is not acknowledged by the merchants. For the present, seed cotton from Rutlam and Marwar comes to Ahmedabad and is being ginned.

4. *Sanand.*—The same mixture of *wagad* and *lalio* as in Bavla occurs as both the varieties are grown in the taluka but cotton from Rutlam is also sometimes brought and ginned.

5. *Viramgam.*—Formerly here there was the mixture of Khandesh cotton (brought from Nandurbar) and of Marwar cotton with *wagad*, but for the last three or four years the gin owners have made a rule not to bring the inferior cottons to mix, and this condition they have decided to observe for ten years continuously so as to fix

the credit of the market for there is no other variety grown in the taluka that can be mixed by the ginners. Thus the taluka tends to grow purer *wagad,* though on the north side in the Chual tract of sandy loam we find slight mixture of *lalio* due to its proximity to Mehsana, where *lalio* is grown.

6. *Bhavnagar.*—The Gogha Mahel that grows *mathio* has its cotton ginned at Bhavnagar where cotton from several places in Kathiawar comes for ginning, pressing and export to Bombay. Some of the states of Kathiawar that do not allow sowing of *mathio* in their limits, such as Wadhwan, Wankaner, Morvi, Lakhtar and Chuda, have their own gins for *wagad* and *lalio* and that cotton generally goes to Ahmedabad direct but some *wagad* or *lalio* brought by the Bhavnagar merchants from these states goes to Bhavnagar, to mix with ten per cent of *mathio* to pass off in Bombay. Similarly, Broach cotton from Broach and Jambusar is brought in small vessels to Bhavnagar and similarly mixed with *mathio* and sent to Bombay, while gin owners of the Broach district take *mathio* from Bhavnagar and mix with the Broach cotton to pass off as Broach in the Bombay market. This is a great evil specially for the Broach district and will have to be watched and stopped some way or another. This is the chief reason I believe why Broach cotton has lost its credit compared with that of Surat.

7. *Anand and Baroda.*—These are places between the Ahmedabad and Broach districts where *rozi* and *kahanmi* are both ginned, and intentional mixing is more common here than elsewhere. Cotton from Mehmadabad, Nadiad ane Kapadvanj and Petlad of the *rozi* variety is sent by railway as seed-cotton to these places and mixed with *kahanmi* and sent to Bombay or Ahmedabad as *kahanmi* This mixture of superior and inferior cottons is injurious both to trade and cultivation as at Dholka.

8. *Ranpur.*—Round about Ranpur, *wagad, lalio* and *mathio* are being grown and the mixture in the fields in some cases has become very complete. A similar rule has recently been made by the gin owners to that at Viramgaum, with regard to the ginning of mixed seed cotton.

9. *Dhanduka.*—*Mathio* cotton from the Barwala tract of this taluka used to come to this place when there was no gin at Barwala and was mixed with *lalio* and *wagad.* The *wagad* of this place becomes ready in March and *lalio* in February and these two varieties

also can be kept separate if desired but are being mixed. As the Ranpur centre is showing some combination for improvement, Dhandhuka also will probably improve as people are likely to follow the example of Ranpur and Viramgam.

The whole business of mixing is done in the proportion of ten per cent of inferior seed cotton with the better quality, to get the higher rate of the better variety and the effect is not so much on the Ahmedabad market as on the Bombay market where the cotton mostly goes. Broach and Bhavnagar and Anand and Baroda have lost their credit. Rs. 15 to 20 per *khandi* are offered less for the higher class cottons of the more northern districts than for the same type from Surat. The *bohras* who are the petty merchants of Broach, Baroda, Dholka and Kathiawad are reported to be the chief offenders whose action has spoiled the reputation of Gujarat cotton.

The only remedy that gin owners can apply is by a combination of gins not to gin the mixed cottons of different types. This is done by the Viramgam merchants and seems to be observed. Ranpur, as already stated, has lately taken up the same policy and if it is continued, the credit of the market will improve.

Marketing of Cotton.—The general method regarding the marketing of cotton in the Ahmedabad district is for the petty merchants or for the agents of big merchants to go to each village and buy the cotton there. Only ten per cent or so of the crop is brought to the cotton centres by the cultivators themselves. The chief centres from which the agents go in the district are Bavla, Dhandhuka, Ranpur, Bhavnagar, Viramgam, and chiefly Ahmedabad and the cultivators are not charged commission as is the case in Khandesh.

When the lint is sold after ginning by these small merchants, the purchasers have to pay various charges, as follows. The amounts very slightly for different parts of the district.

(*a*) 1 maund of seed cotton (40 lbs.). | *Dalali* ½ to one anna; *Adat*—1 pie ; *Dharmada*—1 pie ; Ginning 4 annas; Hauling 1 pie.

(*b*) 1 maund of lint (40 lbs):—*Dalali* 1 anna ; *Adat* ½ pie; *Dharmada* ¾ anna.

(*c*) 1 bale :—Cleaning and hauling 5 annas ; Pressing Rs. 4 to 5 ; *Dharmada* 2½ annas to 4 annas. (Bale = 400 lbs).

The detailed charges for some of these centres are also quoted below :—

Bavla :—*Wagad* and *lalio* come to the gin as good cotton out of which one third comes as *lalio* and two thirds as *wagad*. The local maund is of forty pounds. The small merchants have to pay *dalali* of Re. 1 per Rs. 100 worth of *wagad* seed cotton and eight annas for *dharmada*, while for *lalio* Re. 1 is charged for *dalali* for seed cotton worth Rs. 100, and four annas for *dharmada*. For hauling the cotton to the gins the charge is 1½ annas for every twenty five maunds of seed cotton.

For lint for every 40 lbs. *dalali* is 1¾ annas and 4½ lbs. of lint are deducted from every *kacha* bale of nineteen *kacha* maunds and one anna for weighment per bale.

For every pressed bale the gin owner pays 4 annas and the purchaser pays 4 annas as *dharmada* for charities such as *Sada Vrat*, water to cattle, temple expenses and *Panjra-pol*. The ginning charges are Rs. 2 per 24 *kacha* maunds while for pressing Rs. 2 to 4 are charged per bale usually.

Ahmedabad.—The seed cotton is bought by the agents of Ahmedabad Mills and by petty traders in the direct and sent to the Ahmedabad gins. The petty trader pays the charges charged for *dalali adat*, and weighment as at Viramgam and not the cultivator. Four annas are deducted for *dharmada* for every bale. The ginning charges are Rs. 4 to Rs. 5 for every *bhar* of twenty four *kacha* maunds while for pressing the charges are Rs. 3 per bale, usually, though they sometimes go to Rs 5.

Viramgam.—The seed cotton is chiefly bought by petty traders, though some of it comes direct to Viramgam. Only pure *wagad* comes to the gin and the maund is of forty lbs. The *dalali* for seed cotton for every maund is half an anna, and *dharmada* is four annas for cotton worth Rs. 100. The *Panjra-pol* and other charities take one and a half annas per cent on the rupee value of the seed cotton.

For lint, the *dalali* is one anna, for 40 lbs. and *dharmada* four annas for lint worth Rs. 100. The sub-brokers get Rs. 11 per 100 maunds.

For every bale pressed Rs. 5-2-6 are the pressing charges including *dharmada*. The buyer charges nine annas as *dalali* for every 100 maunds of lint, and the weighing charges are twelve annas per 100 *kacha* maunds. Out of the nine annas taken for *dalali*, one anna goes to *dharmada*.

Bhavnagar.—The seed cotton is generally bought from the cultivators at forty one pounds per maund, and one rupee is charged for *dalali* for cotton worth Rs. 100. For *adat* half anna per maund is charged to the purchaser. The *dharmada* charges are two annas for every twenty five maunds of lint. For every twenty five maunds of lint, two seers are deducted as a sample and half a seer for *goshala*. Three annas are charged for weighment taken by the State, two and a half annas are charged in addition for every twenty five maunds of lint coming from outside of Bhavnagar State.

Ranpur.—Petty merchants buy the cotton while only ten to fifteen per cent is brought direct to Ranpur by the cultivators The maund is forty pounds at Ranpur, and forty two pounds near Rotad. The charges for weighing, *dalali*, *goraxan* and *imam* are four annas per twenty maunds of seed cotton. For lint, for every twenty five maunds the *dalali* and *adat* together cost Rs. 1-8-while for filling and carting lint to the press the charge is eleven and a half annas per twenty five maunds. For pressed bales two and a half annas are charged as dharmada to the press.

Acreage under cotton.—As for the area under cotton, in each taluka, of each variety, a statement is given below from which the total under each variety in the District, and the total under cotton for each taluka can be seen in acres.

Name of the taluka.	*Wagad.*	*Lalio.*	*Kahanmi.*	*Rozi*	*Mathio*	*Gadario*	Total.
Dholka. ...	40120	10310	...	...	...	...	50430
Dhandhuka.	56909	33940	3443	...	26500	260	121052
Gogha. ...	...	...	...	...	400	...	400
Sanand. ...	22416	1536	...	...	...	...	23952
S. Daskroi....	3700	6074	...	...	...	...	9774
N. Daskroi...	222	6524	...	10	...	...	6756
Viramgam....	124193	...	...	...	...	...	124193
Prâtij. ...	159	714	...	...	...	...	873
Modasa. ...	...	...	387	8	...	...	395
Total.	247719	59098	3830	18	26900	260	337825

The detailed description of each taluka if given hereafter in all respects regarding soil, rainfall, rotation, variation of cotton grown, manuring and seed supply with remarks on possibilities of improvement,

(*To be continued*).

Notes on Certain Aspects of Cotton Marketing at Navsari.

BY

M. L. Patel, B. Ag.

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THE cotton market at Navsari is very largely derived from the Chikhli, Bulsar, and Jalalpur talukas of the Surat district, and the resulting lint is well-known as probably the best cotton of India. Of the three talukas above mentioned Chikhli and Bulsar are regarded at Navsari as producing a slightly higher quality of cotton than Jalalpur. This does not necessarily mean that the seed cotton is less valuable. In fact, at Bilimora, which is a big cotton centre, Jalalpur seed cotton obtains a somewhat higher price owing to its higher ginning percentage.

The manner in which seed cotton is marketed is as follows. The cultivator, carting his own seed cotton to market, is met by *dalals* or brokers of the merchants in the town, and informed the prevailing rates of the day. At times he bargains at his village with the brokers and carts shortly after, and at times he sells in advance. The merchants whom the *dalals* represent buy the cotton at these rates, get it ginned and sell the lint to a separate set of merchants who only deal in lint. These purchase the cotton in half-pressed bales.

The mechanism of the transaction is peculiar, and in part depends on a special series of weights and measures which prevails in the market at Navsari. These are as follows:—

One *maund* of seed cotton = 38 pounds.

One *bhor* of seed cotton = 24 maunds and 12 pounds, or 924 pounds.

One *kandy* of lint at Navsari = 21 maunds, or 798 pounds.

One *kandy* of lint at Bombay = 784 pounds.

The basis of all rates in the Navsari bazars is the Bombay price for lint of the type usually obtained from this market. From this, however, a very large number of expenses are deducted besides the legitimate ones of freight and similar changes, and the resulting rates are Rs. 7 to Rs. 15 per *kandy* below the rate which should prevail, by natural parity, in Navsari. As a matter of fact the normal price of Navsari lint in Bombay is Rs. 15 to Rs. 25 higher than Surat cotton. The ordinary difference at the Surat and Navsasi market is not greater than Rs. 8 to Rs. 10.

In calculating the price to be paid to a cultivator for seed cotton, the merchant, moreover, always deducts Rs. 12 to Rs. 15 for expenses from the fixed rate per *kandy* for lint. This means that the price per *bhor* of *kapas* or seed cotton is reduced by Rs. 4 to Rs. 5–8. Further the payment is always made a fortnight after delivery, and no interest is allowed for this period. Thus the cultivator appears to be mulcted at both ends. He loses Rs. 4 to Rs. 5–8 per *bhor* in the calculation of the rate for his seed cotton on the Navsari price for lint in half-pressed bales and he loses again Rs. 2–8 to Rs. 5 because the price at Navsari of the lint is calculated on a lower basis than the Bombay price. The cultivator's total loss usually comes to Rs. 6–8 to Rs. 10–8 per *bhor* of seed cotton.

This result is in the normal course of business. But the profits of the middlemen may be considerably greater from practices which yield nothing to the grower of the cotton at all. For instance it is the custom to sprinkle water on the ground where the half-pressed bales of lint are to stand on the night previous to the day on which the full pressing is done. Water is again sprinkled on the ground where the full pressing is done when the cotton is spread out. These two wettings add three to four pounds per bale to the weight of the cotton. It is, moreover, calculated that one pound per bale is added by transfer to the wetter climate of Bombay.

The whole calculation may be given for one particular lot of cotton.

	Rs. a. p.
(1) 1 *kandy* of lint (798 lbs.) requires 2579 lbs. of seed cotton costing Rs. 190 per *bhor*.	446-10- 8
Price of 1748 (46 maunds) of cotton seed at Rs. 31 per *golly* of 30 maunds.	47- 8- 6
(Loss in ginning 33 pounds.)	
Nett price of 1 *kandy* of lint at Navsari	399- 2- 2
(2) Charges against this cotton.	

Charges on seed cotton.

(*a*) Brokerage on buying seed cotton at 0-7-0 per *bhor*.	1- 3- 6
(*b*) Ginning charges Rs. 4 per *bhor*.	11- 2- 6
(*c*) Kacha baling charges for 1½ bales at Rs. 15 per 100 bales, and hire of cover at As. 5 per gunny.	0- 12- 3
(*d*) Weighment charges for seed cotton, heaping seed cotton &c.	0- 4- 6
(*e*) Interest and insurance.	0-11- 7
(*f*) Brokerage on sale of kacha bales of lint.	1- 0- 0
(*g*) Weighment charges of lint in half pressed bales, and carting to press.	0- 4- 0
(*h*) Labour charges in weighing.	0- 4- 0
(*i*) Numbering bales	0- 1- 6
(*j*) Sampling charges.	0- 1- 6
(*k*) Charges for examining lint	0- 4- 0
(*l*) Charity	0- 3- 0

Charges on full pressed cotton.

(*m*) Pressing charges at Rs. 4-8-0 per bale.	9- 0- 0
(*n*) Weighment and labour charges for full pressed bales.	0- 4- 0
(*o*) Bill Discount.	0- 8- 0
(*p*) Commission.	2- 2- 0
(*q*) Railway freight to Bombay.	3- 2- 0
(*r*) Discount of 5½ per cent on the grand total (Rs. 455)	24-14- 8
	Rs. 455- 5-4

(3) Deduct the difference (14 pounds of lint) between the Navsari and the Bombay Kandy	8- 2- 0
Net total cost of cotton in Bombay.	447- 3- 4

Thus we have, in summary,

Original cost of lint, in Navsari per *Kandy*.	399- 2- 2
Cost after ginning and in kacha bales.	413- 4- 8
Cost in half pressed bales.	415- 6- 8
Cost fully pressed and delivered in Bombay	455- 5- 4
Cost of one Bombay kandy would be	447- 3- 4

At the time in question the Bombay price for this Navsari cotton was Rs. 477 per kandy. If another middleman is introduced in Bombay, the profit of Rs. 30 per kandy would be reduced to Rs. 26.

The seed cotton merchants calculate increase or decrease in the Bombay rate per kandy is equivalent to an increase or decrease of Re. 1 per *bhor* of seed cotton.

At first sight the enormous proportion of the final price which disappears in commission and charges can not but strike the observer. It would appear possible to eliminate a good many of these charges and I am confident that when the matter is carefully studied it will be found comparatively easy to do so, and so bring a larger proportion of the final rate into the pockets of those who produce the cotton.

A Step in the Rural Economy of Khandesh.

BY

V. V. Gadgil, B. Ag.

Superintendent, Dhulia Farm.

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THE cultivation of Cotton has changed the whole aspect of Khandesh and the area under this crop is gradually increasing every year. Twenty years ago the cultivator was not very particular about his cotton-crop and he used to dispose of his *Kapas* either by "*Jalap*" or through travelling agents of the cotton merchants. In the *Jalap* system, the produce is generally sold in advance at a fixed rate, which is often far below the current rate of that season. This was simply due to the ignorance of the cultivator. He was also a stranger to market tactics. But as time went on the same Khandeshi farmer came to know where he was losing and preferred to sell his commodities himself in the bigger markets. Further progress has been made by some cultivators in separating their *Kapas* into lint and seed at the ginning factories which are generally situated in the Cities.

It has been generally observed that it usually pays a farmer to gin his cotton and sell the lint and seed separately as the chances of fraud are minimised by this process. If the cotton lint weighs less than is expected the owner of the gin will be the loser, as the charges are calculated on the weight of lint turned out from the gin. This weighment made by the gin owner, is generally accepted by the merchants if the lint is sold within a reasonable time. In the case of cotton seed the weighment is taken by the local *dalals* who look more to the interests of the merchants than to the loss of the cultivators.

Further advantage in ginning on the account of the farmer will be seen in the percentage of lint found in different qualities of cotton. The importance of " N. R." cotton has been already dealt in the past issues of this magazine and it is needless for me to repeat the same. But the most important merit of this variety is the higher ginning percentage the full benefit of which can only be secured by converting the *Kapas* into lint and seed. It is therefore a matter of prime importance that every cultivator who grows "N. R." cotton, should try his best to get the *kapas* ginned before selling.

The third advantage of ginning by the farmer on his own account is that it helps to keep the variety pure. Of course certain precautions have to be taken at the time of ginning. It is a well-known fact that the present mixture of Khandesh cotton, has originated from the ginning factories which supply cotton seed to all the surrounding villages. The experience of the Agricultural Department for the past seven years tends to show that the pure "N.R." seed purchased by general cultivators is converted into a serious mixture of several varieties within a period of three or four years. This is partly due to the want of purification of the standing crop but more generally to the negligence at the time of ginning. In this connection I do not find fault with the cultivator as he has no voice after the seed-cotton is handed over to the gin owner. Thus although the advantages of ginning are clearly seen by the cultivators, they prefer selling the seed-cotton to undergoing the bother of ginning.

Formerly there was keen competition among the gin owners themselves and everyone was anxious to induce the cultivators to bring his cotton for ginning in his factory. But as the number ot ginning factories has increased, very few of them get sufficient work; and to get over this difficulty the gin-owners form what they call a "combination" for fixing the rate of ginning per *palla* (240 lb.) and also for running or closing any factory according to their choice. Such combinations leave no chance to the farmers as the whole monpoly of having cotton ginned is given to the merchants. In some places where such a combination has not been brought into force very interesting competition occurs among the gin-owners for securing a large quantity of *Kapas* for feeding their own gins. But when cotton prices are on the rise, the cultivators, claims for ginning accommodation are set aside and preference is given to the merchants who engage the whole gins at any cost.

Taking all the above circumstances into consideration there is a good deal of difficulty in seeing how the cultivators can get their *Kapas* ginned on their own account. However, since the introduction of oil-engines into the districts a few intelligent cultivators are trying to solve this problem by installing a ginning plant in their own localities and thereby providing the facility of ginning to the cultivators under their own supervision. Such experiments have been made at Shirpur, Sakli, Jalgaon, Bildi, and Pimpri in Khandesh and these seemed to have proved quite successful under efficient management. To make this matter more clear I will record below the experiment of a gentleman of Pimpri, who has erected a ginning plant very recently.

The idea of starting this business occurred to him during the latter part of the past season and he undertook to purchase the gins and oil-engines in the month of January 1917. The actual work of ginning was started only from the middle of February. To purchase two single roller gins and one oil-engine of 8 brake horse power with all its accessories required a capital of Rs. 2700-0-0 and the season for ginning lasted only for three months. The daily output of work was over 3½ *pallas* of lint in a working day of twelve hours (from two gins) and he realised Rs. 860-7-0 as the total charges for ginning. The expenditure for running the gins, repairs, petty purchases etc. came to Rs. 582-12-0. If this amount be deducted from the ginning charges, he has made the nett profit of Rs. 327-11-0 in this bargain without counting any interest charges. The ginning charges per *palla* varied from Rs. 4-8-0 to Rs. 8-0-0 according to the quantity on the cotton. In the item of expenses the depreciation value of the machinery has not been included as the owner lost 3½ months of the best time of the season which would have given him an additional income of Rs. 400-0-0 while the depreciation value will not exceed Rs. 270-0-0 at ten per cent. Thus if he had worked the gins for the whole season he would have got twelve per cent interest on his capital during the ginning period of one year and for the remaining months of the year, he can utilize the engine either for pumping or grinding the latter of which has become one of the necessities of a modern village. The experience at Bildi, although not quite so encouraging, confirms on the whole the opinion I have expressed and I am anxious to see similar efforts made in every village to get out of the hands of the gin-owners of the large centres.

In this connection probably ultimately it will be found that the proper way of proceeding is to induce the villagers to start a co-operative ginning plant and to keep it running under the management of the village *panch*. The question of capital is not very serious in Khandesh as many people are willing to invest the required sum when the advantages are brought home to them.

During last October I had the opportunity of visiting similar plants in the Akola District of Berar while studying seed-Unions in the Central Provinces and I am glad to note that the results of such plants are most encouraging. At Gargaon, the ginning plant (costing Rs. 2550-0-0) has given a nett profit of Rs. 1200-0-0 during the year 1915-16 while the profits realised by the Union exceeds Rs. 3000-0-0 in the distribution of pure "N. R." seed.

The Bombay Agricultural Department is also working on similar lines from the current season and there are now seven co-operative seed societies recently started in Khandesh. If the necessity of having a special ginning plant be brought to their notice, I am sure that they will derive immense benefit from the installation of a gin as well as from the distribution of pure seed. Besides the spread of "N. R." cotton will be so rapid that the whole tract will be sown with this variety within a period of five years. The quantity of "N. R." seed distributed by the one seed-Union of Gargaon came to 132232 lbs. during 1915-16 and this was equal to three quarters of the seed turned out by the whole Agricultural Department in Khandesh. I hope that this is a sufficient testimony to attract the attention of the public to this important step of rural economy.

Cotton cultivation in the Rajpipla State.

BY

S. P. Pandya, B. Ag.

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THE Rajpipla State is situated south of the river Nerbudda, east of the Broach disrtict, and north of the Surat Collectorate. It comprises an area of 1517½ sequare miles with a length of 60 miles from east to west and a breadth of 42 miles from north to south. The average rainfall of the different districts of the States varies from 35 to 52 inches. The maximum temperature ranges from 98° F-108° F. and a minimum from 40° F.—50° F. Most of the rain falls within four months, July and September being the months of the heaviest rainfall.

The State can for agricultural purposes be divided into two tracts. The first tract skirting the river Nerbudda, includes Nandod, Bhalod, Jhagadia and the western half of Valia taluka, and represents the black, medium black, *besar*, *goradu*, and *kachhot* soils. These soils are of high fertility, producing all kinds of dry crops and under irrigation a variety of garden crops. The second tract is hilly and mountainous and is agriculturally of little importance. Of the dry crops raised on the above soils, cotton is receiving a large share of attention from the cultivators of the State and is by far the most important both on account of its commercial demand due to the ever-increasing growth of the textile industry and the profitableness of its cultivation owing to the market at present being very high.

Of the total cultivated area of the State over thirty three per cent is under cotton. This enormous increase of nearly twenty per cent within a period of twenty years is due to the opening of a railway line and construction of a network of inter-roads, which not only have facilitated the transport of agricultural produce, but have brought the agricultural class of the State in touch with outside markets and other centres of agricultural activity.

The types of cotton at present grown by the farmers are *goghari* and *deshi*. The former has gained ground chiefly because it is a short stapled, coarse, hardy variety, characterised by high yield and a high ginning percentage, while *deshi* is a long stapled fine variety with a lower ginning percentage than that of *goghari*.

The cultivators find *goghari* more profitable to grow as it fetches a better price per acre, and as the whole of the commercial intercourse of the State farmers lies with the Broach district, they have invariably and indirectly imitated their neighbours in point of growing this variety. Deshi is now grown only in Valia taluka an area quite close to the Surat Collectorate.

Cotton is generally rotated with *rabi jowar* and preparatory tillage begins in the hot weather. If cotton is taken after *jowar* the stubbles are grubbed up and collected and the field is then harrowed up twice or thrice with a heavy bladed harrow. When the first monsoon showers wet the soil, the land is ploughed and harrowed and made ready for sowing purposes. The seeds are prepared for sowing according to the usual method by mixing them with a thin plastering of cowdung and mud and then rubbing them on a string bedstead. The seed rate varies from seven to ten pounds per acre.

The usual distance between the two rows of cotton plants is from twenty two to twenty four inches but of late the distance between the two rows of cotton plants is regulated by two different systems namely the " partial fallow system " and the " Vashil system. " Continuous cropping of cotton in the same fields year after year has a deteriorating effect on the outturn of seed-cotton per acre, and hence of late the cultivators have taken up to the partial fallowing of the fields. According to this cotton seeds are sown at a distance of forty eight to fifty two inches or even seventy two up to one hundred four inches, instead of twenty two to twenty four inches as is usual in drilling cotton seed.

The advantage of this system is that cotton is taken in the same field year after year without any rotation whatsoever. The intervening space is thoroughly and constantly kept stirred, and an effective mulch is thereby kept up, evaporation is checked and cotton plants thrive with great vigour as more space, more plant food and more water is at their disposal. In the Vashil system the field is manured thoroughly cultivated and kept fallow for one year so that what is lost in the first year is made up for by the enhanced outturn of seed cotton next year.

It is a common practice in the Rajpipla State to grow a coarse variety of rice, *Dhundhani*, subordinate to cotton in the same row of cotton, or between two or more rows of cotton. *Tur* (*Cajanus* *indicus*) is also drilled in two or three rows after every tenth or twelfth row of cotton.

Interculture begins when the plants are six inches tall. Three to four bullock hoeings and two to three handweedings are given. In September-October when evaporation is rapid, a country plough is passed between the rows of cotton plants to check evaporation. Cotton plants begin to flower in October-November, and picking begins in February, unless the season prolonged by abnormal heavy late rains. Three pickings are taken generally. The average outturn of cotton per acre varies from 300–400 lbs. per acre and rice subordinate 400–1000 lbs. per acre. When the cotton field has been fallowed the outturn of seed cotton per acre is 600–900 lbs. and that of rice 1500–2000 lbs. Such fallowed fields are only few in number. Broach, Ankleshwar, and Palej are nearest centres where the whole of the cotton is marketed. The State cultivators get about ten per cent less than the Broach cotton, though the variety grown is the same. This is due, I think, to the unscrupulous dealing of the merchants who look only to the quantity and not to the quality and who do not fail to take advantage of the relatively ignorant cultivators.

Cotton is the only crop which receives manurtial treatment of the cultivators, tweniy to twenty five loads of farmyard manure per acre being the usual application. Cotton fields however do not receive manure every year but only once in three or five years.

Among the insects ravaging the crop *Katra*, stem borer, and boll-worm are the chief. *Katra* is found eating the leaves of the crop in the beginning of the monsoon when the cotto is in the seedling stage. Of other diseases Rhizoctonis and the woolly mite are found infesting the fields, but rhizoctonis has of late made a considerable advance in places where continuous cropping of cotton is practised.

The problem of cotton improvement centres round improving the strains-of the two varieties–which should be higher in yield, higher in staple and higher in ginning percentage. This can be done if strict attention is paid to the following points.

(1) Maintenance of seed supply by the selection of seeds of a pure type.

(2) Regular application of manure to cotton fields every year. If farmyard manure is coarse, green-manuring with *san* (*Crotolaria Juncea*) would be the cheapest manure available and at the same

time most responding to crops, improving the physical condition of the soil.

(3) Slight modification is the method of sowing cotton seeds either by wider spacing of the rows of cotton than at present or by dibbling the cotton seeds at a distance of three feet by three feet.

(4) Thorough subsequent cultivation of the land after sowing the cotton crop, by way of hand weeding and interculturing the crop, thus checking the evaporation and creating an effective mulch so essential for dry farming.

(5) Practice of judicious rotation which may help to prevent the constantly increasing Rhizoctonia and other diseases.

(6) Lastly marketing the cotton crop co-operatively and storing the seeds in separate bags by getting the seed cotton ginned separately under strict supervision.

Cultivation of onions near Veraval and its possible improvements.

BY

Shivalal H. Vasavada, B. A. B. Ag.,

Inspector of Agriculture, Junagadh State.

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ONIONS form one of the main irrigated crops round about Veraval and their export to Karachi and Bombay from the port of Veraval alone amounts annually to a value of Rs. 1,50,000 or thereabouts. Variety under cultivation in this district is highly valued for its keeping qualities and there is an organised business in the town of Veraval with regard to the storage of the onions during the six months of the monsoon when the sea remains closed for shipping

Soil.—The soil at Veraval is alluvial and deep and varies in texture from drift sand near the coast to brown or medium black loams one or two miles inland. The medium black loams are found to be ideal for the cultivation of this vegetable crop. They are more than three feet deep and can retain moisture for a very considerable time.

Season of growth.—The monsoon crop of onions is unknown to this district, but the Surat system of planting bulbs to get a very early crop has been given a trial during the last year. But as a rule the crop is raised from seedlings transplanted during the cold season. Transplanting is done by instalments and a single cultivator may be found to have crops transplanted in December, January, and latest during the first week of February and it has been found by experience that the crop that ripens early in March fetches a much higher price than that which is harvested in May or June.

Rotation.—Dry monsoon crops like *bajri*, *jowar*, *til*, and irrigated crops like hot weather *jowar* (*shalu*), lucerne etc., are some of the crops taken in rotation with onions. The crop is taken as a rule every third year in the same field, with a bare fallow during the previous monsoon.

Cultivation.—Onion requires a thoroughly clean and deeply cultivated soil. Four or five ploughings during the months of September and October with two or three harrowings with a toothed cultivator (*dantai*) and a blade harrow (*kaliun*) bring the soil into a satisfactory condition. The land is there after levelled with a samar. Clods here and there are crushed with hand labour and the soil is brought to an excellent tilth and divided into long but narrow beds fifteen feet long by five feet wide.

Manure.—The only manure in common use in this district consists of partially rotten town sweepings or such refuse of the farmyard as cannot be converted into cow-dung cakes during the rainy season. The farmers give twenty five cart loads of this manure to an acre of onion land and more often much less than that since the quantity available is quite insufficient for the area planted.

Seeds and Sowing.—Seeds are raised from selected medium sized bulbs and are sown in a small area of fine texture during the months of November and December. Some successsful trials have been recently to have a very early crop, by raising seedlings in September or October.

Transplanting.—Seedlings are pulled out from their beds when they are sufficiently developed in a month and a half, their tops and roots are pruned and they are then transplanted at a distance of four to six inches according as the soil is rich or poor. It may be here remarked that this distance is based upon the principle of controlling the size of the bulbs. This operation is done in dry soil and water follows immediately behind the operator. The transplanting has thus to be limited to an acre that can be watered on the same day by the grower.

Irrigation—The loams near Veraval are very retentive and the second watering is done after twelve days. But as a rule one Persian Wheel of the type most commonly used in the Konkan can maintain fifteen bighas or six acres of irrigated onions at a time. The crop reaches its maturity in three months and thus requires six waterings in all. When the crop reaches the stage of maturity its leaves begin to turn yellow and its shoot begins to droop. At this stage further watering is completely stopped and it is allowed to stand for a fortnight or more.

Harvesting.—Digging out of the onion bulbs is done with the aid of small iron bars (*kos*) and they are allowed to lie in the field for two or three days. Thereafter the tops and the rootlets are cut off with a scythe, the bulbs are headed in the field and are finally packed in sacks for market. Each sack is found to contain on an average one hundred and twenty pounds of the dried onion bulbs.

Outturn.—The outturn of this crop varies considerably according to the richness of the soil and the availability of manurial supplies and is rarely found to exceed 20,000 lbs. per acre.

Market Value.—As is found with other vegetable crops in our country, the prices of this crop vary considerably from time to time. The accompanying graph representing the market value of this crop at Veraval during the last three years will show that its price falls down almost to nothing. When the sea remains closed to shipping, from the middle of May to the middle of September and the price is lowest during the months of May and June when the season's crops flood the market. It will also show that the maximum price will be offered for onions during the months beginning from September and October when the sea opens for the export of all the stock that has been stored during the monsoon in well ventilated stores by the dealers in this crop. It will be clear to the observer that the growers of this crop are not usually lucky enough to get the high price which it commands during some months of the year, and their earnings hence often hardly bring them enough to meet the cost of cultivation and rent.

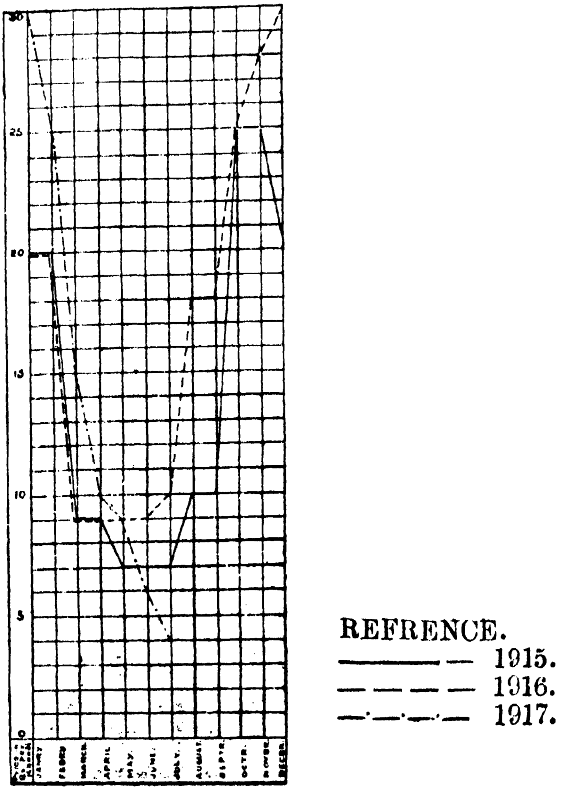
Concluding Remarks.—The difficulties of the onion growers of this district are thus manifold and their salvation lies only in directing them by way of practical field demonstrations towards:—

1 Taking earlier crops of onions to get a better price.

2 Making trials to increase the outturn of the crop per acre which can safely be raised to 30,000 lbs. per acre on an average.

3 Educating them and helping them up towards co-operative credit and co-operative storage and sale of their products directly to the Bombay and Karachi markets.

GRAPH SHOWING VARIATION OF PRICES OF ONIONS AT VERAWAL.



Fencing Against Wild Pigs.

BY

V. R. Dharwarkar, L. Ag.

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IN the Bombay Karnatak, owing to the large area still under jungles, wild animals destructive of crops are so numerous that the wise cultivator in jungly tracts needs think of ways and means of adjusting his cropping plan so as to reduce their ravages to a minimum. From villages bordering on the jungle the cultivation of cane has almost disappeared ; in such villages wild pigs and jackals are the chief depredators but of these wild pigs are by far the most destructive.

Different methods are tried in these parts for reducing their numbers. In many villages land owners are granted gun licenses by Government on condition that they shoot a certain number of pigs every year. Attempts are also being made to destroy them by employing low caste tribes who are accustomed to hunt pigs with dogs. The extent to which these different methods of destruction can reduce the damage done by pigs is almost inappreciable for while they in the aggregate, probably account for the death of a few thousands every year, hundreds of thousands of young pigs are being born. It is evident therefore that some other device of a more practical nature must be adopted if success is to be attained.

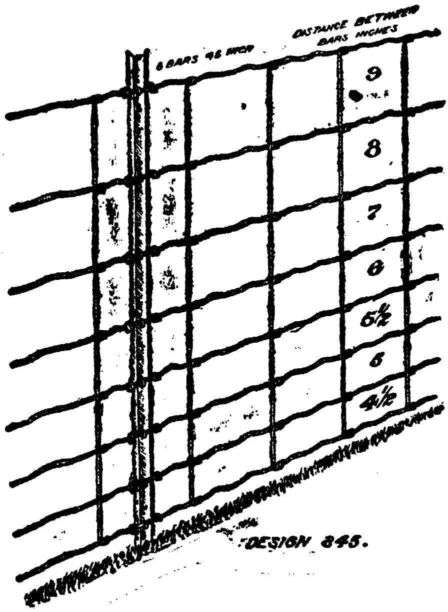
Confronted with this great difficulty of protecting valuable crops, experiments have, for the last three years, been made with different types of pig fencing. The Department of Agriculture have tested two types namely "Titan Woven" and "Netting."

The details of cost of both fences and a brief description regarding a few practical points which should be observed when erecting these fences will, I think, be useful.

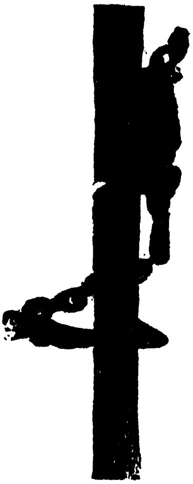
(1) and (2)
The Stretcher in use.

(2)

(3)
" The Auto-matic
Stretcher."



(4)
General view of "Titare fence ".



(5)
The " Auto-matic
Stretcher " mounted
on a port.

Fixing Corner and End Posts.—When wooden posts are used, the first two posts at either end of the line should be long enough to admit of setting them four feet in the ground, and they should be not less than six inches in diameter at the small end. The length of the post must be ten feet.

In setting the wooden end post, anchors should be used. Anchors on a post should be well spiked and the post dressed just enough to get a good bearing surface. The anchors may be made of any solid piece of wood two feet long, six inches wide, and two inches thick. The anchored post should be placed so that the top anchor will bear against the ground in the direction the fence is to be pulled. Every particle of earth should be pressed down hard in filling the holes so the posts will be as solid as a tree.

The corner post should be anchored similarly to the end post excepting that one more anchor is attached to brace it in both directions.

Line Posts.—Wooden posts seven feet long, and four or five inches in diameter in the top are suitable. The best results are secured by setting them at least two to two and a half feet in the ground and then thoroughly tamping the earth round them.

Should there be a hollow or depression in the ground along the fence line, it will be necessary to anchor a post at the low point, the anchor being placed so that the fence shall not pull the post out of the ground. If concrete is used in setting a post in the depression the best results are obtained.

Size of holes.—It is impossible to make any hard and fast rule as to the sizes of the holes to dig for corner and end posts, as the nature of the soil, the length of the stretch and the character of the concrete to be used all have a bearing on this. However in ordinary soil for an end post, a hole sixteen inches wide, eighteen inches long and three and a half to four feet deep has been found ample. The hole should be longest in the direction of the line of the fence. For a corner post a hole of twenty four inches square, and four feet deep will do.

Concrete for setting Posts.—Concrete is ordinarily made from a mixture of slacked lime and sand in the proportion of 1 : 2. For the setting of fence posts it is not necessary to make so strong a concrete as is required for many other purposes. The above proportion has given very good results. Mixing can best be done on a corrugated iron sheet. The above concrete mixed with double the quantity of gravel and made thoroughly wet can be used for setting posts.

How to Erect the "Titan" Fence. The Automatic Stretcher.—With the post chain fasten the stretcher to, and at a proper distance from, the end post so that the wood brace will not interfere with the free operation of the dogs on the stretching chain. Operate the lever on the back or side of the fence line opposite to that on which the fence is to be stapled.

Connect the stretching chain with the wood clamp by the large hook, placing the hook so that as nearly as possible there will be the same number of bars above as below the hook. This equalizes the strain. After leaving the dogs the stretching chain should pass at the back of and between the circular guides at base of the dogs. These guides help to hold the chain straight and are especially helpful in releasing.

A swivel is provided in the chain whereby the chain can be straightened either before the strain is put on or after a few links have been taken up. Be sure to get the stretching chain straight before any heavy pulling is done, as even a quarter twist in the chain will seriously interfere with the operation. The dogs should slip into place on the links without any pounding or other assistance. If the stretching chain is straight it should not be necessary to touch any part of the stretcher except the lever either in stretching or releasing.

For a lever use a good sound stick of wood or two and a half inch pipe from five to eight feet in length.

To stretch the fence, simply move the lever forward and backword sufficiently to allow the dogs to engage the links of the chain.

To release the chain the movement is the same as in stretching except you go a little further. In other words to release you force the lever sharply toward the fence until the little pin in the spring case slips into its slot. Then move the lever in the opposite direction and foremost dog will back away from the chain and engage a lower link. After the lower link is engaged, again press the lever toward the fence and the other dog will be released. Continue until all strain is off. Then fix the staples over the wire post on alternate wires.

Keep the working parts of the stretcher well oiled, including the points of the dogs that engage the links of the chain.

Results of using the fence.—To demonstrate the actual use of this fence against pigs in cultivators' fields, intending to put fences it was first undertaken by R. S. M. L. Kulkarni, on his private land on the Dharwar Mugad road. The fence when put up was much appreciated by cultivators with the result that four more cultivators ordered the same kind of fence to be put up. The Titan woven wire fence No. 845 was ordered for four persons viz :—(1) Raosahib M. L Kulkarni, (2) Mr. Narayan Bhidu Hebsur of Amblikop, (3) Hon. R. B. Naik of Ranibennur, (4) Mr. S. N. Karagudari of Hangal.

The Deputy Director of Agriculture has brought another type of pig proof netting. In price it is much cheaper than the woven, being Rs. 0–3–11 per yard delivered at Dharwar. Two cultivators viz :—(1) Mr. Wamanrao Kelkar of Haveri and (2) Mr. S. N. Desai of Kallapur have taken up this fence to protect their crops from stray cattle, goats, pigs, jackals, and wild cats etc. Mr. Desai of Kallapur grows sugar-cane where pigs &c. cause damage to the crop to a considerable extent. The cost of putting pig proof Titan woven fence No. 845 round a plot of 30 acres near Dharwar was as below:—

		Rs.
Price of ⅞ mile fence at 6 annas per yard ...		580
Railway freight on above from Calcutta to Dharwar		35
Cartage on the same from Dharwar to the fields ...		3
Price of 400 wooden posts at Alnawar... ...		150
Railway freight on above from Alnawar to Dharwar		9
Unloading charges on above		3
Cartage on above from station to plot		20
Price of staples		12
Fixing charges of the fence viz :—		
Wages of carpenter	Rs. 18– 6–0	
Digging pits	,, 33– 7–0	
Collecting metals for concrete ...	,, 10– 3–0	
Price of tar	,, 10– 7–0	
Price of slaked lime	,, 11– 0–0	
Applying tar to posts... ...	,, 2– 8–0	
Fixing Posts..	,, 46– 6–0	
Stretching and stapling ...	,, 23–13–0	158– 2–0
	Rs.	970– 2–0

or approximately Rs. 1050 per mile.

In the above work the price of the fence was six annas per yard while at present the rate is Rs. 0–5–6 per yard. The ordinary rate for the fence before the war was Rs. 0-4-6. If it is calculated at the rate before the war the cost of the above fence will be about Rs. 900 per mile. A good deal of cost of putting up the fence depends upon the prices of the posts and the rate of wages. Mr. N. B. Hebsur of Amblikop with personal exertions got the posts at an average price of 4 per rupee delivered at his own place. The rate of wages too was lower at Amblikop are given below :—

Price of 700 yard Titan woven fence ...	241–10–0
Railway freight on above from Calcutta ...	24– 0–0
Cartage on wire from Dharwar to Amblikop .	3– 0–0
Price of 200 posts at 4 annas each ...	50– 0–0
Price of coal tar...	3– 0–0
Slaked lime for mortar	6– 0–0
Labour for digging pits, fixing posts &c. ...	30– 0–0

Total cost for 700 yards. Rs. 357–10–0

or approximately Rs. 900 per mile.

The details of cost of the pig proof wire netting ordered by the Deputy Director of Agriculture and put up at Haveri by Mr. Kelkar are as below :—

Price of 400 yards of wire netting at Rs. 0–3–11 per yard including railway freight up to Dharwar...	97–14–8
Railway freight on above from Dharwar to Haveri...	2– 0–0
Price of brace wire No. 8 for pins 45 lbs. ...	6– 1–6
Price of barbed wire 1 bundle 88 lbs.	13–13–0
Price of 100 teak wood posts at 4 annas each ...	27– 8–0
Wages of carpenter	3– 0–0
Digging corner and ordinary pits for posts ...	6– 0–0
Price of mortar filling the post pits	12– 9–0
Price of coal tar	3– 0–0
Stretching charges	4– 0–0

Total cost of 400 yards Rs. 175– 5–2

or approximately Rs. 775 per mile.

The prices of these fences are now very high, so that many cultivators have dropped the idea of erecting these fences for the present.

With these fences there is a great scope for cultivation of valuable crops like sugarcane and other garden crops in tracts bordering jungle. There are excellent valley sites with fertile soil here and there in the interior of the mallad tract, which with pig-proof fence around and a tank on the top would make most valuable lands for growing sugarcane.

The Health of the Agriculturists:

BY

Dr. Socrates Norenha, L. M. S., B. Hy.

THERE is an analogy between the masses of soldiers that are hurled daily on to the battle field to defend our country from a hostile invasion and the vast number of agriculturists that are poured on the fields to keep us away from our natural enemy-famine. Both the soldier and the peasant are patriotic. The one tills and sows the soil, the other patrols and guards it, both working in one common direction, the preservation of our natural integrity.

But the analogy stops here, it is sad to say, because the two great armies do not receive like attention. The gorgeous uniforms of our fighting men appealing to our æsthetic senses, the political and social bearings that they hold at their bayonet's point appealing to our ambitions, the humiliation of another nation appealing to our pride, are all a long string of human passions finding a vent in the glorious display or heroism at the cost of human lives.

To us, poor vain mortals, the hero of the struggle for life seems to be the man who, in a fit of temporary insanity wades through bloodshed to hoist up the flag of our cravings and not that strenuous nation-builder who in the silent hours of day and night without the sunshine of popular appreciation and with his name on no man's tongue toils to keep going this great machinery that supplies the food of the nation !

There is especially a fact that stands in bold relief when we see that the powers that we have such a large proportion of their attention concentrated on military improvements.

I allude to the great problem which stands behind all thought of progress in every path of life-sanitation-and to the efficiently organised details of the splendid military hygiene which stands in marked contrast with the little that is done in rural sanitation. Both are our equally important national duties, the agriculturists especially being, just now, an imperial necessity and asset.

The necessity of keeping soldiers healthy has so impressed the military authorities in recent years, that it is now proposed that not only professed medical men should be employed, but also that ordinary officers of the army and navy should receive some trainining in the modern methods of warding off disease, so that they may impress their value on the rank and file with whom they are in daily contact. The underlying idea is that the work of the Sanitary Staff attached to the army will be enormously simplified if each individual is taught to look after himself to a certain extent.

The suggestion of this very practical measure suggested to me the idea that something similar introduced into the Poona Agricultural College would prove of highly beneficial effects to the *officers* and *men* of the Agricultural army, and personally, I venture to think that people who have no Sanitary Staffs and Sanitary paraphernalia to follow them, as the fighting soldiers have, very seriously need the knowledge of a few rudiments of the general principles of hygiene.

Who does not recognise the innumerable dangers to which the cultivators are exposed in their daily labour? The development of Agricultural implements even, means increased danger of wounds and hence danger of tetanus, anthrax, or malignant aedema, from organisms that abound in manured soil. Is not cattle-rearing a permanent menace to them with all the diseases from which these animals suffer and which are transmissable to men? Water borne diseases like cholera and typhoid, the diseases transmitted by insects, snake bite etc., are all at the door of the cultivators. Malaria causes the death of millions of people in this country. Twenty thousand die annually of snake bite. Ninety lakhs of human lives have been sacrificed into plague alone. Sleeping sickness threatened a permanent depopulation in certain parts of Africa some time ago, and is still playing havoc there. Yellow fever prevented the colonisation of the isthmus of Panama for four long centuries and when Lesseps began his plan of cutting the Panama Canal human life was sacrificed for every cubic yard of earth excavated!

Students of Agriculture! just imagine the enormous amount of good that you can do to yourselves and to the working classes under you if you only know and apply the knowledge, that mosquitoes, flies and other similar biting and blood-sucking insects that carry malaria, elephantiasis etc., can be very easily killed in the larval stage in collections of water; that bacillary diseases like typhoid and cholera can be prevented by covering wells and using a pump or by simply disinfecting or boiling the drinking water; that tetanus can be avoided if you burn a recent wound or go to the nearest doctor before the fatal symptoms set in; that a few crystals of potassium permanganate and a lancet (Lauder Brunton's pocket case) will save many a life from the poisonous effects of a snake bite.

Side by side with your own work a little knowledge of proplylactic measures against human diseases is never a waste and may prove eminently useful to you all.

In my next article I shall go into the etiology and mode of transmission of a few diseasee that the Agriculturists are exposed to through soil insects and cattle and give some practical hints on the methods of avoiding them. I shall try and give just a little insight into what may save mankind from giving present tribute to death, and thus make a passive contribution towards increasing the manurial value of our land, just a little insight into the working of this other great army that furls its banner of protection with the motto "Sanitas sanitatis, omnia sanitas."

Problems in Coconut Cultivation.

BY

R. Correia Afonso,

Coconut Planter, Margao, Goa.

IT is just a year past since I wrote a few notes* on the cultivation of coconuts for publication in the Agricultural College Magazine. In that article I tried to set right what I considered to be a mistaken point of views from Mr. V. S. Habbu. Now, on reading an article by Mr. P. C. Patil in the July number of this magazine, on the same subject, it occurred to me that it might be useful to coconut cultivators of British India to place before them a few results of my observations and experience. It happens, moreover, that some of my views are in antagonism with those of Mr. P. C. Patil and my presenting them to the public may provoke a discussion which will surely result in the benefit of a cultivation which is of the greatest importance to the coastal portion of western India.

When I stated last year that coconut seedlings should not be planted at any depth below the level of the ground, but should be planted quite close to the surface, I had nothing but my own experience to bear testimony to the correctness of my assertion. Since that time, however, people who may be considered authorities in the subject of cocology have come to hold the same views. In a book† published comparatively recently, the authors call *unwise aud disastrous* the practice of planting coconut seedlings with the root collar at any depth below the surface of the surrounding soil the book is profusely illustrated to illuminate this point of practice to which I was led by many observations. I noticed in several occasions that seedlings from whose surroundings the earth was washed away accidently grew more vigorously than those planted deep and remaining so. I likewise observed that young plants that looked sickly and miserable had regained health on the soil around them being removed. I had also seen that in the nursery those seeds which partially remained above ground make much better seedlings than the completely buried ones and everbody knows that a tree should find in the field practically the same conditions in which it has grown in the nursery. It was similarly brought to my notice that trees planted on small hills of earth, which is sometimes done in these parts of the Konkan, were much better yielders than the surrounding trees. I believe that all these facts, along with the authority of Messrs. Brown and Morris to bear me out in my assertions, or sufficient for me to be absolutely emphatic in revocating this system as against the old system of planting in pits. I have in my plantations specimens of either which are sufficiently illustrative and any body is welcome to see them.

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* Agriculture College Magazine Vol. VIII. No. 2 (October 1916).

† "Practical Guide to coconut Planting" by Messrs. Morris and Brown 1916.

Correlated with this is the question of how seeds should be placed in the nursery. Mr. P. C. Patil wishes them to be *covered well, leaving only the tops above the ground.* I find, however, that the major portions of the seed should be left exposed above ground and Mr. Brown thinks that they should be just slightly pressed into the soil. I follow this method in my nursery with extraordinary success. This method need not surprise any one when one knows that in the Phillipine Islands seeds are hung up around a pole, without any contact with and soil, and left in this eleveted position to germinate. In other countries they are tied in pairs to horizontal sticks, either method being only suitable for very humid climates. The root development is scanty but the plumule develops normally. This method is suggested for places where slow growth of the seedling is required.*

On the subject of the time for setting out the seedlings in the field I must say that August is the *worst month* for the operation. Here in Goa, it is only the lazy gardener or the one whose ideas of farm management are directed towards avoiding trouble will plant his seedlings in August. And he is generally the worse off. Between January and March all the best seedlings will have been brought from the nurseries by active planters. In the British Konkan, I should think, the conditions of climate are practically the same as those of Goa. In August the soils are cold and have hardly recovered from the effects of the heavy showers of July. As everybody knows, the August plucking of the nuts is the poorest, the nuts being formed more or less twelve months before, that is, in the August of the previous year. If, therefore, August is the least beneficial time of the year for a well established coconut tree, the young seedling will naturally suffer in a similar way.

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* Cope land, "The Coconut" page 111, with illustrations of method.

And then, what seedlings should be selected for transplanting in August? The nuts plucked in March to May and placed in the nurseries in the beginning of June are not yet ready for transplantation. The seedlings of the previous year, being now fifteen months old will suffer a severe shock on being uprooted for transplantation and in August they will not be able to strike root fast enough. The reserve material in the nut will by this time have been totally used up. The opinion of all the planters is that the seedling should be so young that the material in the nut is not all exhausted, the sufficiently old to have a small trunk formed which will be able to withstand the stoppage of supplies caused by the cutting of the roots. The ideal time is, therefore, that followed in Goa, January to March with seedlings from the previous June which have completed their germination by September or October. Until the monsoon the seedlings must be irrigated.

Among the many uses of the coconut husks, Mr. P. C. Patil does not mention in his article their suitability as manure or mulching material. As such they are even more valuable than for fibre manufacture, and under no circumstances should they be allowed to leave the plantation on which they were produced. It is true that the practice of using the husks as above is frought with danger where the beetle pests are particularly strong, but this danger can be averted in either of two ways—by sprinkling them with salt or sea-water before spreading them among the trees or by burning them and using the ash as manure.

Reviews of some new books in the Agricultural College Library, Poona.

——:o:——

BOTANY.

B. 910. An introduction to a Biology: by A. D. Darbeshire, Cassell 1917.

A book to be read by everyone. In the preface Darbishire's sister gives a sympathetic account of his life, his labour and his heroic death. As one of the foremost workers in the field of mendelism, Darbishire was well known. In 1911 he accepted the newly created post of Lecturer in Genetics at the University of Edinburgh. When war broke out he was on a lecturing tour in America. Returning to England, he was at first refused admission to the army on account of physical delicacy but in July 1915 succeeded in enrolling as a private in the Argyll and Sutherland Highlanders. On Christmas day of the same year he died of disease. Here we have one more splendid example of patriotism now inspiring the nation. This fine Scientist, this accomplished experimenter, yielding up his life as a private soldier.

The book is intensely interesting to any thinking man. Much of it is of immediate practical value. The attention of first year students is invited to the following sentence on page 53 "When a man cannot draw, it is because he cannot see truly". Third year men will find considerable new material regarding breeding in the latter pages.

B. 911.	The Carnation Book	by H. H. Thomas.
B. 912.	Sweet Peas	Cassell & Co. 1916.

Excellent books on special subjects, essential to everyone deserving up-to-date information regarding culture and varieties.

B. 923. Evolution by means of Hybridisation, by J. P. Lotsey Nijhoff 1916. A book for advanced and post-graduate students, fairly speculative and decidedly stimulating.

CHEMISTRY.

C. 904. 'Inorganic Chemistry' by W. A. Shenstone (new Edition) (Edward Arnold, 41 and 43 Maddex street, Bow street, W. London, 5 S. 1915). It is an excellent book for extra reading for the Intermediate Agriculture class. Hints on practical exercises are useful. The students should attempt to solve the quantitative problems given in the body of the book and at the end of it.

C. 905. 'The Organic Constituents of Plants and Vegetable Substances and their chemical analysis' by Dr. G. C. Wittstein, (M'Carron, Bird & Co., 37 Flinders Lane, West, Melbourne 1878). This is a good reference book on the above subject and the chemistry students will find it useful for reference.

C. 907. 'Soap Manufacture' by W. L. Godd (G. Bell & Sons, Ltd., London, 1913, Rs. 5). The author gives in a short space a clear idea about the manufacture and analysis of soaps. Although it is meant for persons connected with soap making even a general reader will find it interesting.

The G. D. Mehta Memorial Fund.

The undersigned has great pleasure in acknowledging receipt of the following contributions for 'The G. D. Mehta Memorial Fund', upto 11th October 1917.

Mr. N. V. Kanitkar	10
,, G. S. Mhaskar	10
,, S. V. Shevade	10
,, D. K. Bhatt	10
,, M. G. Athalaye	10
,, J. M. Talukdar	5
,, P. R. Desai	10
,, T. N. Javeri	10
,, M. L. Patel	8
,, M. M. Desai	6
,, V. M. Mazumdar	3
,, G. D. Gupta	5
,, D. L. Sahasrabuddhe (part payment)	20
,, Y. R. Joshi	2
Mr. S. K. Dutt	2
,, V. A. Tamhane	20
,, D. M. Ranade (part payment)	5
,, B. B. Jamaspijina	2
,, T. V. Nagarshet	10
,, G. S. Kulkarni	10
,, V. G. Gokhale	50
,, R. G. Padhye	5
,, R. S. Kasargode (part payment)	10
,, K. M. Powar (part payment)	5
,, B. S. Patel	30

D. L. SAHASRABUDDHE,

HON. SECRETARY.

College and Gymkhana Notes.

THE disperse for the holidays began on the 15th September. It is surprising how quickly the rooms at the quarters were vacated. The place looks desolate enough and we hope that as soon as the month is over everybody will return to a life of activity and work with a refreshed body and lively spirit.

It is expected that a short time after the reopening of the College for the second term, the Senior B. Ag. students will start on their Agricultural tour. It is a great pity that owing to the strained conditions of the Government Treasury, due to the war, the tour has to be very much curtailed. The students, however, are willing to make the most of the short time at their disposal.

Of all the events which are marked in the College Calendar with a red letter, the social gathering is the one to which the students look forward with the greatest pleasure. The Social gathering for the current year has been fixed for the 7th and 8th December. Mr. Shirgaokar has been elected general secretary. We are sure that although men of equal capacity are to be abundantly found among the students, none better than Mr. Shirgaokar could be entrusted with responsible task of organising the events for the social gathering. It is expected that the members of the Board of Agriculture, which meet in Poona in the first week of December will honour us by their presence at our gathering and sports.

The Students, Union under the presidentship of Mr. D. L· Sahasrabuddhe, with Mr. K. V. Herlekar as secretary started its activity for the current year with a concert which took place some time in August. It was fully attended and those of the students who are in good terms with music provided to their less fortunate brethren a most pleasant evening. We are sure that the Union will keep up its reputation in the second term by arranging for such gathering oftener ; college life would be rather dull without these meetings, for men cannot subsist on bread and butter alone.

Under the auspices of the same union an inter-class foot-ball match was arranged. The first match between the Senior B. Ag. and the L. Ag. classes was played on the College of Engineering ground, sometimes in the beginning of August. Unfortunately it proved also to be the last match. We cannot dertermine upon the reason of the sudden stoppage of a pastime which seemed to be most pleasing to spectators and players alike. Is it that the proper spirit is lacking or are the bodies weak ? We hope somebody will enlighten us on the matter, since we are convinced that it was no material impediment that put a stop to an amusement that promised so well.

We are told by some that the explanation of this defection on the part of the students is to be found on the fact that there is not, all the world over, the smallest piece of ground which we might call our own, and to go a-begging for other people's ground is a disgusting affair. In this splendid manner the powers that we contribute towards the development of the sporting qualities in us.

We are prepared to admit the reasonableness of the above statement. But what is the Gymkhana Committee doing ?

We offer our hearty congratulations to Dr. H. H. Mann, and Prof. J. B. Knight on their being temporarily promoted to the offices of the Director of Agriculture and the Principal of the College respectively. It will not be out of place to say that these personages are undergoing a sort of preliminary training that will befit them to fill these " commissioned Ranks " in the future permanently.

⁂ ⁂ ⁂ ⁂

We have great pleasure to note that in the Indian Defence Force, our College has been represented by Messrs. Kanhere, Kabraji, Jayawant and Hardikar We congralulate these gentlemen on their splendid response to the call of the Motherland and wish them nothing less than a brilliant career throughout their military course. Would that the response had been generous ! But we know that there are many difficulties in the way like the tours in the First and Final years and the practical courses to be undergone for which we have to make allowances.

⁂ ⁂ ⁂ ⁂

It is heard that Dr. W. Burns is instructed by the Military Authorities to join the Indian Army Reserve Officers. We are indeed very sorry to lose this our Professor of Botany. At the same time, we are proud that he is one of us and is getting an opportunity of actively serving the Empire.

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Our readers will be interested to know something of our graduates of last year. Many have joined Government Departments and a few have gone in for private enterprizing:

Mr.	Deshmukh	Educational	Department	C. P.
,,	Chico	Agricultural	,,	B. P.
,,	Muzumdar	,,	,,	,,
,,	Bhagwat	,,	,,	,,
,,	Baluch	,,	,,	,,
,,	Desai	,,	,,	,,
,,	Patil R. S.	,,	,,	,,
,,	Shaikh M. U.	,,	,,	,,
,,	Patel A. H.	,,	,,	,,
,,	Joshi D. N.	Educational	,,	C. P.
,,	Jani	,,	,,	,,
,,	Patil H. C.	,,	,,	,,
,,	Gorwankal	,,	,,	Private
,,	Tiwari	,,	,,	,,
,,	Jamaspjina	Bombay	Co-operative	Department
,,	Shetti	,,	,,	,,
,,	Yettinamani	Revenue	Department	Bombay
,,	Master	Agricultural	Department	Bombay

Private Enterprise.

Mr. Gadre S. G.
,, Deedie.
,, Joglekar.
,, Joshi, Y. R.
,, Nadig, S. R.

Obituary.

Sam N. Kothawalla.

We regret to announce the death of Sam N. Kothawalla which occurred on the 9th May 1917, under tragic circumstances. Kothawalla was a first year student but he had made himself known to all the College students by his affability and kindness. Kothawalla was a promising student and had already made a name as a sportsman. Those of us who know him intimately shall miss him very much. We shall live in the memory of his fellow students. We accompany his family in their grief.

THE PROGRAMME OF MARATHI VICHAR VIKASINI SABHA AGR. COLLEGE POONA FOR THE SECOND TERM 1917-18.

Time—5 p. m. Sharp.

Date.	Lecturer.	Subject.	President.
21st November 1917 Wed.	Prof. S. L. Ajrekar, (B.A.)	Student Life in England	Prof. R. P. Sabnis, B.A. ...
5th December 1917 Wed.	Mr. G. K. Tatke ...	Foreign Capital and the prosperity of the nation.	Prof. D. L. Sahasrabuddhe, L. Ag. B. Sc.
19th December 1917 Wed.	Mr. D. B. Bhongle ...	Communal Representation	Mr. V. R. Kothari, B. A. ...
19th January 1918 Wed.	Mr. G. P. Jambhekar ...	National Universities and their line of work.	Prof. G. B. Patwardhan, B. Sc.
23rd January 1918 Wed.	Mr. M. N. Kamat ...	Imperialism	Prof. S.L. Ajrekar B.A. cant.
30th January 1913 Wed.	Mr. V. A. Tahmane ...	Research in Science	Prof. S. S. Godbole ...

G. P. JAMBHEKAR,
R. P. KANHERE,
Secretaries.

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EDITORIAL.

THE BOARD OF AGRICULTURE, POONA, 1917.

WE have recently, in December 1917, had the honour of a meeting of the Board of Agriculture for India in Poona. Once in every two years the Government of India call together for consultation representatives from the staff of the agricultural and veterinary departments in every province, and also men from the headquarters of the imperial agricultural department at Pusa. Such a meeting evidently ought to be a very important affair. You have, gathered together, men who are steeped in the agricultural problems of the country, who are daily in touch with the real difficulties of the people, and whose mutual discussion of these matters ought to lead to big steps in progress.

The meetings were first instituted in 1905. At first they were annual and more always held at Pusa. Then it was considered that meetings once in two years would serve the purpose, and they have since been held biennially, and alternately at Pusa and in one of the provinces. So far, among provincial centres, Cownpore, Nagpur, Coimbatore, and Poona have been visited.

Naturally, at these provincial visits, the local items of agricultural interest claim a considerable share of attention from the assembled delegates. This time large parties visited H. E. the Governor's dairy farm with its pedigree herd of pure Sindhi cattle, the Agricultural College and College Farm, the Manjri sugar cane farm which is one of the most successful of the experimental farms of the agricultural department, the Ganeshkhind botanical gardens with all its experiments on fruit and fodder grasses, the Loni agricultural school, and last but not least, the magnificent collection of water raising appliances shown by the Agricultural Engineer Mr. Schutte. There was no doubt as to the appreciation evoked by these various activities of our Bombay Agricultural department, and we have reason to feel proud of many of the opinions evoked.

So far as the meetings themselves were concerned, there is no space to linger on the more formal parts of the conference—the opening speech of H. E. Lord Willingdon, the remarks made by Sir Claude Hill &c. or to speak of what are after all purely matters of the internal administration of the agricultural departments, such as the character of the publications in which its results are enshrined But there were a number of matters of considerable interest to a wider public, and these demand a few words.

Perhaps the matter of most fundamental importance discussed was as to whether anything can be done by legislation or otherwise to deal with the question of the subdivision of land and scattering of holdings which forms such a terrible hindrance to agricultural progress. To most of those present the problem, as a problem, was new, and yet over enormous tracts of the country, as Mr. Keatinge, who introduced the subject, showed, this subdivision of land smothers any attempt at agricultural improvement almost at its birth. He was for starting with a permissive act, allowing any men to declare a holding indivisible for ever, in spite of Hindu or Mahomedan law, and then such holdings would descend by primogeniture. To some Indian members such as Dewan Bahadur K. R. Godbole, this was not drastic enough. They would have compulsory consolidation of holdings, and then a legislative prohibition of any redivision. Professor Jevons of Allahabad was for the general reorganisation of villages, as a natural result following from a determined effort to raise the standard of life. Though there were nearly as many points of view as speakers, yet the question will enormously benefit by being brought to the front, and as the earnest attention of the Indian provincial governments has been called to the matter, in a year or two acceptable ways may be found for dealing with a problem connected as closely with agricultural success as is the provision of good seed or the use of manure.

Another subject discussed which gave the chance of doing more than direct technical improvement was that of agricultural education, a matter in which Bombay has alway taken the lead. And at last we have got a definite pronouncement from a responsible body representing agriculture throughout India, that the present rural education is, to speak mildly, unsuitable and unsatisfactory. "A sound system of rural education based on rural needs is essential." "The present system is wholly inadequate." "The revolutionary improvements... that are needed." "The provision of necessary fund should form the subject of an *immediate* careful and detailed examination by the various provincial administrations." All these expressions occur in the resolutions adopted by the Board. Of course it is quite possible that these resolutions may lead to nothing, but it is certainly something that an authoritative body like that which assembled at Poona should so definitely demand the ruralising, even at great cost, of the village education throughout the country. Compared with this the clear call of the Conference for definite agricultural schools based largely on our Loni model in every Indian province is a smaller though very important matter. The recommendation is cautious and suggests very gradual development, but it is a thing which, once started, will go ahead by its own momentum. An agricultural College was also demanded for each important Indian province. In connection with the problems of education one may note with satisfaction that a scheme for higher veterinary education was discussed and adopted by the Board.

Another very important matter which was discussed was the improvement of the use of water for crops in areas where irrigation is available. It is extraordinary, seeing that India is immeasurably the greatest country for irrigation in the world, how little has been done to investigate how the water can be used to the greatest advantage, and with the least possible damage to the soil. One would have thought that the possible immediate profit to the Government which owns most of the irrigation canals would have led to the establishment of means for investigation on a large scale long ago. The Board now calls for this, and it certainly would only appear to be a belated granting of what seems an almost obvious necessity, if the demand for such investigations were met at once.

Another matter which might have been of great importance was the question as to what can be done by the agricultural departments to increase rapidly the outturn of food crops in India. In view of the all-but certainty, so economists inform us, of a world famine on an unprecedented scale in the near future, in which India ought to take a large share in relieving other countries, one might have perhaps expected a discussion and adoption of strong recommendations to the Government of India that very large immediate, if temporary, developments in the work of the agricultural departments should take place specially for this purpose. The chief results of the discussion were, however, the emphasising of the fact that seeds of food crops,—especially wheat and rice,—which yield very much better than those in general use are now known, and their pushing should be a matter of great effort in the near future.

The best methods of bringing agricultural improvements to the notice of cultivators were again discussed at the present meeting of the Board of Agriculture. There were however few new methdos to lay before the conference, the most notable being the utilisation of District Boards in the United Provinces as centres of agricultural demonstrations by a special system of giving *tagai* loans to cultivators in the form of seed, manure, and the like which has been developed in Mysore.

Some other subjects laid before the Board of Agriculture demand a short mention. First there was the call for legislation to prevent the sale of worthless artificial manures. The use of such manures is spreading fast, and, as happens in all countries, this is accompanied by wholesale adulteration. There is nothing so easy to adulterate as artificial manure. And the Board endorsed the demand for legislation. In considering the question of the adulteration of Indian exported materials the Conference had the help of Mr. Lindsay, Director of Commercial Intelligence, Calcutta. He outlined a scheme whereby associations composed of members of exporting firms in each port would control the quality of materials exported. It is evident that the matter is being seriously considered by Government, and, if one may say so, not before it was needed. Again, the Board called attention to the need for phosphates in the manuring of Indian soils, and appealed for serious investigation as to how they could best be obtained and applied.

One matter in connection with a report on the Indian sugarcane industry laid before the Board must be mentioned. We seem now, for the first time, within reach of a type of sugarcane for North India which will yield largely and ripen quickly and so enable Northern India to develop a really healthy sugar industry. If this proves to be the case it is of enormous importance to the country.

and Mr. Barber of Coimbatore, who claims to have developed such canes has conferred a benefit on India which can never be forgotten.

On the whole the meeting of the Board of Agriculture was voted a considerable success. Men meet here who hardly ever meet otherwise, and the interchange of ideas which results must be of a good deal of value. It was unfortunate that the Board came to Poona when our college has been dispossessed, temporarily, of its buildings, and when the war has largely prevented for the last three years the development which would otherwise have been expected in the agricultural department which has its headquarters in Poona. But we can only hope that, despite these unfortunate circumstances, this Board meeting will be a point from which great improvements in Indian agriculture will inevitably arise.

A Cotton Survey of the Ahmedabad District.

BY

K. D. Kulkarni.

III Part.

(The second part of the present paper appeared in October 1917.)

——:o:——

DHOLKA.—Soil.—Along the Baramati from Bavla Eastwards up to Vautha, the soil is sandy loam while on the Western side it is *besar*. The Southern part has black soil and the Northern part has rice land which is not very retentive. The subsoil is Goramti or Maid (Yellowish earth mixed with Kankar.)

Water.—Water is found at a depth of thirty to fifty feet which is more or less saltish according to the nature of the soil.

Rotation and Manure.—*Jowar* and *Bajri* are the crops rotated with cotton and cotton is manured with fifteen to twenty cart-loads of farmyard manure per acre. South of Dholka between Koth and Utelia, wheat is grown on a large scale in the black soil of the Bhal tract without manure.

Cotton.—Except villages on the East side of Bavla which grows *lalio*, the whole taluka grows *wagad* cotton.

Lalio is grown on light sandy soil with or without irrigation while *wagad* is grown in the *besar* and black soil. The yield of *wagad* unirrigated is better than that of *lalio* by nearly fifty pounds per acre but irrigated *lalio* yields two or three times the outturn of the dry crop. *Wagad* is not irrigated here as it goes down 1–2 % in ginning if irrigated.

Wagad yields 350–600 lbs. of seed cotton and *lalio* 300–500 lbs. per acre according to locality and the average is 500 lbs. of *Wagad* and 450 lbs. of *lalio*. Under irrigation *lalio* yields 1200 to 1500 lbs. per acre.

The whole cotton of the taluka generally comes to the Bavla gins as it is the best cotton centre for quality for the whole taluka. People keep *wagad* and *lalio* heaps separate in the gins for seed only but ordinarily as *wagad* is valued better than *lalio*, 10 % of *lalio* is generally mixed with *wagad* before ginning.

The tract between Dholka and Utelia grows *lalio* and *wagad* both, *wagad* being more on Dholka side and *lalio* towards Utelia. The tract is called Bhal but more properly speaking beyond Dholka upto 10 miles the land is *goradu* upto Koth, while between Koth and Utelia it is black. Utelia may be considered the limit of *wagad* cotton of the Dholka taluka as three miles beyond it from Fedra pure *lalio* is grown on the whole Bhal tract upto Dholera.

The Thakore of Utelia who takes keen interest in agriculture gets pure seed of *lalio* from Dholera and of *wagad* from Viramgam and gives it to his cultivators and hence this changing tract of two varieties has remained pure from admixture ; otherwise the result would have been as bad as at Dhandhuka where the merchants have spoiled the whole crop round about by mixture of *lalio* and *wagad* seeds.

The sowing time of *lalio* or *wagad* in the Bhal tract is generally at the end of September but sometimes later if the first sowing fails. If the seed is sown in August it always rots due to collection of water in black soil on account of heavy rains.

Mixture.—At Dholka, *rozi* is brought from Mehmedabad to mix with *wagad* and to pass it off as *wagad*, and this intentional mixing has spoiled the reputation of Dholka gins and hence most of the cultivators prefer to send their seed cotton to Bavla and take the pure seed back for their sowing. Some cultivators bring their seed of *lalio* from Palej in Broach.

In the fields round about Bavla, there is a mixture of *lalio* in *wagad* from one to five percent but on the Dholka side the mixture increases to ten per cent and *rozi* is found from two to twenty per cent. Stray plants of *cambodia* and *mathio* are also visible.

Suggestions.—In this taluka, *Cambodia* and *Navsari* were distributed by the Agricultural Department eight years ago but *Cambodia* failed for reasons given before and *Navsari* did not yield equal to *lalio* and also ginned less by 31 %. Pure *wagad* seed that was distributed in the time of Mr. P. R. Mehta was liked by the people and hence a store of pure seed of *lalio* and *wagad* should be kept at Bavla and the seed supplied to the whole taluka with the help of the local merchants. Nearly 10,000 lbs. of cotton seed should be stored for the first year and it should be of the best pure quality, ginned under departmental supervision.

Dhandhuka taluka.—Soil. The taluka is mostly of Talukdari villages. Its soil is either *besar* or black sloping towards the Gulf side while on the western side it is medium black or light red upto Hanpur and round about it, as in Gogha. The medium black tract extends from Dhandhuka westwards upto Hanpur and southwards upto Barwala while further westwards to the end of the taluka it is light red.

Water.—The rainfall is on an average 25 inches to 30 inches. There are very few wells except between Ranpur and Dhanduka, and there are no rivers suitable for irrigation and thus the tract is mostly dependent upon rainwater.

Subsoil.—Between Dhandhuka and Ranpur below the medium black soil there is Goramti and Murum and sweet water is found at a depth of 20 to 30 feet while on the Ranpur side the wells are 40 to 50 feet deep and the subsoil is whitish earth mixed with *kankeri*. In the Bhal tract, west of Dhandhuka below the deep black soil, there is Goramti, and saltish water is found throughout.

Rotation and manure.—Cotton is rotated with *Jowar*, *Bajri* or wheat and is manured at 10 to 15 carts per acre in the *goradu* and medium black soil but no manure is given in the black soil.

Cotton.—The varieties of cotton grown are *wagad*, *lalio*, *kahanvi mathio* and *gadario*.

Wagad is sown in the medium black soil called *kankar*, from Dhandhuka to Sarvala southwards and upto Wagad village westwards while *mathio* and *wagad* are both grown from *wagad* village upto Ranpur Station and south of Ranpur-Dervala Road.

Gadario or *Moto Mathio* is a mixture of N. P. and N. R. C. and cannot be classed as a separate variety but a part of *Mathio*.

Lalio.—Beyond Dhandhuka in the Dholka division and north and east of Dhandhuka in Bhal only *lalio* is grown and is pure.

Kahanvi.—The cotton that is picked from bolls in the field is called *lalio* while that from the bolls taken home is called *kahanvi*.

Mixture.—As for mixture in *Mathio* it is like that of Khandesh but in some fields near Ranpur *kahanvi* add *mathio* are much mixed together. Pure *mathio* is not found anywhere but one to two per cent of *kukanri* is always present in it.

Wagad which is grown between Ranpur and Dhandhuka the mixture of *mathio* is found upto one per cent. Between *wagad* and Dhandhuka mixture of *lalio* is found in Vagad. Within a radius of five miles round about Dhandhuka both the varieties *wagad* and *lalio* are grown mixed, *lalio* being upto 20 per cent in *wagad*, and *wagad* upto 10 per cent in *lalio*.

Suggestions.—As the *mathio* seed is taken from the Ranpur gins, pure N. R. will suit for this locality of Ranpur. But the question is whether we should introduce it, as it is likely to spread from Ranpur rapidly and though Ralhiawar and Ranpur will be profited a little still the superior cottons of the Ahmedabad district (*wagad* and *lalio*) will get more mixed with it and will decrease in area with the introduction of N. R. hence it seems it should not be introduced here to add more to the mixture of varieties.

As *lalio* is sown east and south of Dhandhuka in the Bhal tract and *wagad* westwards in Kanear, while in the transition tract near Dhandhuka both are grown equally, pure seed of *wagad* should be brought from Viramgaon to the extent of 10,000 lbs. and should be kept in Dhandhuka. As the whole taluka is of Talukdari villages, little more can be done by Government.

In the transition tract of Bhal and Kanear, from Dhandhuka southward and northward upto five miles, mixture of *wagad* and *lalio* seed is intentionally done and grown by some cultivators. They believe that according to the season, one of the two will thrive and thus there is less chance of failure by growing them mixed than by growing them singly. It will be better if they grow separate fields with separate varieties as a safety against failure.

As for the Bhal tract, pure *lalio* is grown by the people from Dholera to Gamph and Fedra and the seed is taken preferably from Dholera and it is quite pure in this tract, hence no seed distribution need be made in the Bhal tract. In case of famine they bring pure Broach from Broach and is called *lalio* here. This tract requires no improvement of seed or quality. Besides Messrs. Whitle & Co., have arranged by combination not to gin any other variety mixed with *lalio* in Dholera.

Gogha Mahal.—Except 4 villages the whole Mahal is of Talukdari and is surrounded on all sides by Bhavnagar State.

It is a narrow plain skirting the shore of the Gulf of Cambay with well tilled and well wooded valleys full of springs except a few of the villages that are quite mountainous, growing stunted trees and grass.

Soil.—The soil is a good loam in valleys and shallow red in other places, with six inches to two feet in depth, while the subsoil is chalky or yellowish with murum below.

Rain-fall.—The rainfall is generally 22 inches but the tract has got many streams flowing continuously and there are several wells along the streams that keep the tract rather secure. The water is saltish along the sea-side but it is sweet along the streams ; the depth of wells is from 15–50 feet.

Rotation and Manure.—The crops generally grown are *Jowar*, *Bajri*, and *Til* and rotated with cotton. Manure is given to cotton at 10 to 15 carts per acre.

Cotton.—*Mathio* cotton is being grown in this Mahal for the last 18 years after the great famine of Gujarat of 1899 and due to the lightness of soil and early yield it gives money earlier to the cultivators and thus the variety has settled for the tract where formerly *wagad* was being grown. In yield also there is a difference of nearly 80 lbs. per acre, *mathio* yielding 400 to 600 lbs. per acre compared with *wagad* yielding 320 to 500 lbs. per acre. The ginning of *mathio* is also superior to *wagad* by nearly 3 %. This cotton is a mixture of varieties like those of Khandesh and the seed brought from Khandesh for feeding cattle every year to Bhavnagar nearly 2 lakhs of bags, is used for sowing. At Songadh some people have picked up the early bolls of white flowered variety that ripens earlier and ginned it separately and this seed is being bought by well-to-do cultivators and they find it more paying and better yielding than *mathio*. So here is a small chance to distribute N. R. instead of recommending it for Prantij or Ranpur and from this place it will spread inside Kathiawar by and by as *mathio* did by itself after the famine. *Mathio* yellow flower was being grown in the interior of Kathiawar in Junagadh from a very long time.

Sanand Mahal.—It is bounded on the north by the Baroda State, on the east by Daskroi, on the south by Dholka and on the west by Viramgam.

Soil.—From Ahmedabad upto Sanand the land is good loam while on the south and the west side there is black soil that was unproductive due to saltish water and saltish wells, but which is now improved by drains and tanks of the irrigation department. Rice and cotton are being grown on a large scale and wheat in the *Rabi* season. Tobacco also is an important crop round about Sanand : on the east the Sabarmati river waters some of the best alluvial lands of this Mahal.

Sub-soil.—As the subsoil is *goramti* and then sandy below, the tanks get dry in summer but the wells have got good water supply. Round about Sanand, the wells are deeper and hence rarely used.

Rotation and Manure.—*Jowar* and *Bajri* are the *Kharif* crops of rotation with cotton while wheat and rice are also grown on a good scale. Manure is given at 10 to 15 carts per acre to cotton. Tobacco is generally grown in the same soil year after year.

Cotton.—From Ahmedabad westwards upto Bavla and Sanand *lalio* cotton is grown in the loamy soil while including Sanand beyond westward upto Viramgam the soil is *besar* or black in which *wagad* cotton is grown on a large scale.

Mixture.—At Sanand both the varieties are received for ginning and thus there is the mixture of *lalio* in *wagad* and of *wagad* in *lalio* up to 3 per cent. *Rozi* is also found 1-2 % in *lalio* and that is due to the arrival of *rozi* cotton from the Kaira district to Sanand to mix with *lalio*. *Cambodia* is also found rarely in some fields. Seed that is bought at Sanand of *wagad* is thus not so good as one brought from Viramgam and hence several cultivators on the Chharodi side bring seed from Viramgam and that is quite pure.

Ratlam cotton is also being brought to the Sanand gins to be mixed with *wagad* and *lalio*, and this place will be watched further. A sample of the seed is taken for analysis. The cotton is brought from Ratlam, Fatiabad, Nimach, etc. by Bohra merchants to the Bohra gin of Sanand.

Suggestions.—The *wagad* tract is taking seed from Viramgaon while the tract from Sanand towards Ahmedabad that grows *lalio* should be supplied with pure seed to be kept at the Ahmedabad store for Daskroi taluka.

Daskroi.—The tract is almost flat and is well wooded.

Soil.—The soil is sandy loam mostly, and along the Sabarmati alluvial ; but the southern villages are rather of black soil on Sarkhej side and rice is largely grown there.

Water.—The Hathmati Canal and the Khari Cut both pass through this taluka and there are thus good irrigation facilities besides plenty of wells and tanks and rice and vegetables are grown under irrigation. Rainfall is nearly 25 inches.

Subsoil.—The subsoil is rather *Goramti* or *Maid* while water is found to the depth of 30-60 feet which is generally sweet.

Rotation and manure.—*Jowar* and *Bajri* are rotated with cotton while manure is given at 15 to 20 carts per acre to cotton.

Cotton.—*Lalio* is the variety grown in the taluka and it is sometimes sown with a drill and sometimes dibbled. The seed is generally sold under the name of Palej cotton.

Some villages in the southern portion touching Dholka taluka grow a little of *wadar* cotton but the area is quite small. Northwards it is customary to irrigate a little of cotton under each well and that way the yield improves to double. The ordinary yield of *lalio* in this taluka is 300 to 400 lbs. per acre. Dibbling improves the yield by nearly 100 lbs. per acre and this being appreciated by the people by and by. Besides it saves the trouble of hand weeding.

Mixtures.—The mixture found is of *wagad* upto 4 % and a little of *Cambodia*, *Goghari*, *rozi*, and *mathio* are also found as stray plants sometimes.

Suggestions.—As a seed centre of *lalio*, Ahmedabad will be a convenient place for the cultivators of Daskroi and also of the Sanand taluka upto Sanand where *lalio* is grown. Pure seed of Broach and Palej is appreciated by the people : some 5,000 lbs. of it if kept at the store at Ahmedabad, will make a good start for seed distribution.

Viramgam taluka.—Viramgam is bounded on the north by the Baroda State on the east by Baroda and Sanand, on south by Nal and on the west by Kathiawar and small Run.

Soil.—In the north the soil is sandy from Jakshi, first station of the Messana Line, in the East, it is sandy loam while in the west and south it is open black, low lying and partly saltish. The tract from Zund to Kharaghoda is more and more saltish while a black stretch of soil intervenes between Kharaghoda and Messana Line.

Sub-soil.—The sub-soil is *goramti* or white, below which there is *Mayd* and sand in which saltish water is found at a depth of 10 to 30 feet.

Water.—The rain-fall of Viramgam is 20 to 25 inches and there are very few wells and those also generally saltish. There are several tanks but they are more for domestic use, only a few being used to irrigate paddy and cotton. There are no irrigation facilities of rivers &c.

Rotation and Manure.—⅔rd of the cultivated area is generally under cotton (62 %) while chiefly *Jowar* and partly Bajri are the kharif crops to rotate, while gram and wheat are grown in the black soil without irrigation. Manure is given at 5 to 10 carts per acre for cotton in the *goradu* soil while irrigated cotton gets upto 25 carts per acre. Black soil is not manured for years as it gives more of leafy growth and few flowers and bolls if manured.

Cotton.—*Wagad* is the variety grown in this taluka and on account of the retentiveness of the soil, the crop grows with less rain and the whole area being rather low lying, water accumulates in rains as to allow cotton sowing at the end of August. The yield of this cotton, unirrigated is 350 to 450 lbs. per acre while irrigated *wagad* yields upto 1200 lbs.

Mixture.—There is a slight mixture of *lalio* in *wagad* in the north but the cultivators in this taluka generally get their village cotton ginned separately. Some of the big cultivators get their best lot ginned for seed for themselves and for sale in the village also. The gin-owners allow this convenience to the people which is a rare case in several cotton localities. Thus there is no fear of seed being spoiled. The gin-owners of Viramgaon have besides made a combination of not to gin any inferior cotton like *mathio* or *rozi* and as Viramgaon is the chief centre of the taluka, and of Sanand upto Chharodi, there is no fear of the seed being spoiled and if other gin-owners of other talukas will combine similarly, the whole district will improve rapidly. There is a fine of Rs. 101 for ginning inferior cotton in any gin in Viramgaon.

Suggestions. Except *wagad*, no other variety suits this locality due to untimely sowing and scarcity of labour. Besides, no other variety is superior to *wagad*, in yield or quality and as the cotton does not change colour in monsoon, the bolls can be taken home and cotton taken out for the whole year. Egyptian and American cottons that were tried in this taluka by the Bombay firms and by Government 50 years ago did not prosper well, and *wagad* cotton was alone found to be the best for this taluka.

Prantij and Modasa.—These two talukas of Ahemadabad district are quite detached from the main body by Mahi Kantha and Baroda State.

From the north-east, lines of rocky, rather bare hills, gradually sink west and south into a plain, at first thinly wooded and poorly tilled, then with deeper soil, cluster of trees and a little better cultivation, till in the extreme west the surface is broken by ridges and rivines along tho Sabarmati and Bokh.

Soil.—Soil is sandy loam and in parts there are stretches of black soil in which rice is grown in ;good years. In Modasa peta, some soil is light red with stone just near.

Sub-soil.—Below sandy loam and the black soil, there is *Goramti*, *Mayd*, or white earth while below the red one, there is *Murum*.

Water.—Water is found at a depth of 20–30 feet and sometimes within 20 feet along the side of the Hathmati Canal. In the Prantij taluka, the khari Cut and Hathmati Canal are the irrigation works with the Bokh reservoir. In the Modasa Peta there are no irrigation facilities except the wells and those mostly round about Modasa and Dhansura where wheat and *Jav* are grown.

Rotation and Manure.—*Jowar* and *Bajri* are rotated with *math* and *jowar* in Prantij while maize is the chief crop of Modasa. In Modasa manure is given at 10–15 carts per acre but there is neither good village nor proper care of manure. People being partly dependent upon cattle breeding and milk produce and care very little for paying crops of except but only grow food stuff and fodder for themselves and for their cattle. In Modasa mountains there is plenty of grass and cattle rearing is a part of profession of several people.

Cotton.—Cotton is not grown by them through fear of deer that eat the bolls and a low temperature in winter that shrivels the cotton crop. N. B. cotton is grown on Modasa side and round about Prantij will succeed but it is not safe to start its cultivation as that will add to the mixture of the district crop and will make the poor ryots more dependant on money-lenders as is the case in Panch Mahals, while very little profit will go to the cultivators.

Cotton in Prantij is sown in nearly 900 acres of *lalio* variety and 200 of *Wagad*. While in the Modasa peta on the southern side where it touches the Kaira district nearly 400 acres of *Kahanmi* are grown and as the seed is brought from Palej side it is almost pure. A little of *rozi* is grown as a mixed crop with *Bajri* but *Kahanmi* has almost removed *rozi* from this area. With all that if N. B. is introduced in Prantij by distributing seed from the Prantij store, it will increase the area by and by and will spread towards Modasa and will not suffer from frost, but to the south and north of Prantij, as *lalio* is being grown extensively, in the Baroda territory and Idar State, this introduction of N. B. requires a careful consideration.

Summary of suggestions :—

1. Dholka.—*Wagad* and *lalio* are both grown slightly mixed with one another, while *rozi* and *mathio* are also present more towards Dholka and hence the seed store of *wagad* and *lalio* should be established at Bavla, the chief seed centre of the taluka.

2. Dhandhuka. —*Wagad* and *lalio* are both grown partly pure and partly mixed. Pure seed of *lalio* can be brought from Dholera but pure *wagad* of Viramgaon should be distributed from Dhandhuka centre.

3. Gogha.—Instead of *mathio* pure N. R. may be distributed but the whole taluka is of Talukdari except 4 villages and Bhavnagar State that surrounds the tract may better take up the question.

4. Sanand. —*Wagad* and *lalio* are both grown in the Mahal, *wagad* towards Viramgaon and *lalio* towards Ahmedabad. *Lalio* seed is rather mixed and should be replaced by pure seed of *lalio* from the Ahmedabad.

5. Daskroi.—Mostly *lalio* is grown in this taluka but it is mixed with *rozi* and *Goghari* a little. So pure seed of Broach should be distributed from the Ahmedabad centre.

6. Viramgaon.—Pure *wagad* is grown in this taluka and no improvement is necessary or possible.

7. Prantij & 8. Modasa.—Little cotton is grown in this tract through fear of frost and poor cultivation. N. R. could be grown with better cultivation but its introduction will spoil the credit of *lalio* grown north and south of this tract.

Note on protecting the cotton flowers from natural crossing.

BY

G. L. Kottur,

Cotton Superviser, S. D.

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NATURAL crossing takes place in all cottons to a more or less extent and its seriousness has been demonstrated and admitted in all countries. The Indian varieties cross freely with each other and when these are grown together in breeding plots or in comparative trials care is necessary to maintain them pure. For the same reasons all promising strains evolved from single plants must be protected. In fact the danger from natural crossing is so great that every seed allowed to ripen in the usual manner is of doubtful origin.

Natural crossing can be prevented by growing the cottons in bee-proof cages. It may not be, however, possible to provide such cages and moreover they are unnecessary in many cases, when only a small quantity of the pure seed is needed. Single plants can be protected by netting. But the netted plants attract the jackals and are damaged by them. They also suffer seriously from the attack of aphis. Under these circumstances it has been found very convenient to protect few flowers on every plant required pure for propagation.

The usual method of protecting the flowers is to cover them by means of small paper bags. Bagging presents certain difficulties. The paper used should be strong enough to bear the beating of the surrounding branches especially when the wind is blowing hard. The tying also should be done carefully, otherwise the bag goes off the flower. The expense and trouble in making the bags and putting them on to the flowers is also considerable. Taking these things into consideration another method was tried by the writer last year and was found to be very effective. Rings made of thin wire were employed in place of paper bags. These were put on the fully developed buds before they commenced opening. The form of the flower being a cone there was no difficulty in putting the rings tight and these prevented altogether the opening of the petals. Further, the stalk of the protected flower was marked by a piece of cotton thread attached to the ring. The following figures illustrate the thing :—

Fig. 1

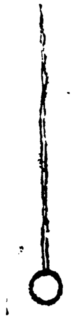


Fig. 2

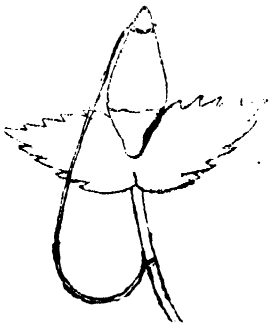
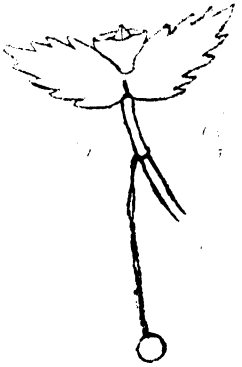


Fig. 3



The method is easy, simple and inexpensive. It therefore claims general application on all the farms where the necessity of maintaining the varieties pure is felt.

Experiments in the Picking of Cotton.

A LETTER TO THE DIRECTOR OF AGRICULTURE, BOMBAY.

BY

Sardar Mahaboobalikhan, Brother Nawab, Savanur.

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(A copy of the following letter and attachments **was submitted to the Principal, Poona Agricultural College by its writer, and the matter seems of sufficient interest and importance to warrant its inclusion in the college magazine. —Editors.**)

I had, about two years back, submitted to you a report containing a few suggestions regarding improvement of the quality of the present deteriorated Coompta cotton and also pointed out the advantages of adopting a new improved method of picking *kapas* from day to day as the pods opened instead of waiting till the whole field was ready. I now beg to enclose a copy of that report for ready reference and also a copy of a report by L. Mc-Lewrick, Esq., Manager of the Gokak Falls Mills, on four bales of Coompta grown on my lands, picked according to the improved method advocated by me and sent to his mills for a test. The result is satisfactory, and you will agree, more than justifies the improved method of picking, as it possesses the advantages mentioned in my former report.

I therefore request you will kindly arrange to publish in your Agricultural Magazine my report and the result of the test by the Gokak Falls Mills so as to bring the advantages of the improved method of picking prominently to the notice of the cotton growing ryots.

The ryots may perhaps say this improved method is costlier than the one at present in practice. It is true the cost of picking *kapas* which according to the present method is about Rs. 15 per *Nag* of 48 *maunds* , may go up to Rs. 25 per *Nag*. But it will be seen from Mr. Mc-Lewrick's report that *kapas* picked according to the improved method will fetch at least Rs. 275 per *Nag* more while the same quantity picked according to the old method fetches only

Rs. 250, thus leaving a balance of Rs. 15 per *Nag* in favour of the improved method, after making due allowance for the Rs. 10 extra cost involved in the improved method.

Another noteworthy advantage of this improved method is that it ensures good value for the produce at all times as it gives no room to unscrupulous persons for adulteration, whereas the old method, by giving every facility for this vicious practice, puts into the pockets of these men the money that should justly go to the growers, besides causing less to the mills in this country.

Neither our cotton growers nor the labourers employed by them realise that all this mischief can be avoided if they only adopt the improved method of picking. The chief cause of this, I think, is their want of education and enlightenment. Even the ordinary labourers of other countries, *e. g.* Japan and America, more fully understand in what lies the benefit of the country than the majority of the educated persons here. In our country agriculture is looked upon as below the dignity of the educated.

To improve the quality of the Coompta easily and without much expense, I humbly suggest that Government be approached to pass a law prohibiting such of the cotton growers as are found to have spoiled the quality of the *kapas* by omitting to adopt the improved method of picking from again sowing cotton seed in their lands and communicating this to the ryots of all the villages through the proper channel. This may for some time cause trouble to the ryots but the advantages to the country will, I think, outweigh these.

I have been in the cotton business for the last twenty years and have fully raised the loss caused to our country by not adopting suitable methods of growing and picking *kapas*. So I approach you with a request that you will give this matter your kind consideration and do what is deemed expedient.

I beg to mention here one more point in favour of the improved method inadvertantly omitted in the report by Mr. Mc.-Lewrick. At a personal interview he gave me to understand that at the spindles it took the same amount of *kapas* to spin seven ounces of yarn from Coompta picked according to the improved method as it required to spin six ounces of yarn from ordinary Coompta.

ATTACHMENT No. 1.

Letter dated the 17th August 1917, from the Manager, Gokak Water Power and Manufacturing Co., Ltd., Gokak Falls to the Sardar Mahaboobalikhan, Brother Nawab, Savanur.

With reference to the four bales of cotton you sent us some time ago and which for reference we have called "Savanur Special" though you tell us that the only speciality about it was systematic picking, we congratulate you on your success, for the cotton was extraordinarily clean. The colour was rather whiter than the Coompta cotton we are used to, while the staple was equal in length to that of ordinary Coompta. This cotton lost in the blow-room about 5 per cent against 7 to 8 per cent loss in our own Coompta ginned *kapas* and about 12 to 14 per cent of ordinary Coompta cotton purchased from outside suppliers.

Inside the mill your special Savanur worked equal to and gave the same results as our average Gokak cotton except that it lost less in the blow-room.

Taking your cotton to the spindle we got :—

(1) *20s count*—20·83 actual count. 70 lbs. average test, against our Gokak Coompta.

(2) *20s count*—30·00 actual count. 72½ lbs. average test. Savanur Special in :—

34s count—33·61 actual count. 33¼ lbs. average test, against our average Gokak Coompta.

34s count—34·48 actual count. 34 lbs. average test. So from this you will see that the test etc. is about equal.

From the above you will see that cotton carefully picked is worth about seven to nine per cent more than cotton ordinarily bought from respectable merchants, though you will for some time find it difficult to get a better rate out of the various markets until buyers fully recognise that your supplies will always be clean.

ATTACHMENT No. 2.

Copy of the letter dated 2nd June, 1915, from Sardar Mahaboobalikhan, Brother Nawab, Savanur.

Subject :—Deterioration of Coompta cotton and how to remedy the defect so as to improve the cotton in quality.

I respectfully beg to submit a few suggestions regarding the improvement of the quality of the Coompta cotton. This is grown in abundance in our district. The quality of the Coompta, now arriving in the markets, is deteriorating year by year and if things are allowed to continue, the Coompta, reckoned upon as second only to the much valued Broach in quality as well as in staple, will in the next five years or so lose its name and consequently the ryots as growers of cotton will have to suffer greatly. I should like to point out here that during the last decade the Coompta has been gradually diminishing in value with the Bombay purchasers. The difference between the prices of the Broach and the Coompta was Rs. 10 ten years ago, but now, owing to the deterioration of the Coompta the difference has widened to Rs. 40.

There are various reasons for the present fall of our Coompta in quality, prominent among them are the following, which, if not treated as calling upon the immediate attention of Government in their Agricultural Department, would certainly grow very serious with too obvious results. It is a custom with the ryots growing cotton on this side of our district, to pick cotton after the whole field has the pods fully open. Many times the *kapas* merely lies hanging from the pods entirely at the mercy of the gusts of the wind which, as a matter of course, bring the hanging *kapas* to the ground. The *kapas* while being picked gets invariably mixed up with dirt and mud. The plants dry up and thus a good deal of leaf dirt finds its way into the kapas for the above reason. And nowadays this leafiness of the cotton has been the main cause of the fall in quality of the Coompta.

I will deal later on as to how this leafiness become the *bane* of the Coompta.

In order to improve the present deteriorated quality of the Coompta, immediate steps should be taken to warn the ryots not to pick the cotton all at once after the whole field has burst but gradually as the pods open. There are two advantages by this picking method (a) Labourers will be always available as there would be no simultaneous picking with a rush of every field in a village. (b) There will be no loose *kapas* hanging from the pods to be shaken by the winds to the ground thus getting mixed with earth rendering the *kapas* quite dull in colour. This dulness of colour will certainly be avoided if picking of the pods as they burst is introduced. Also the picking should be done from daybreak to early noon that is till 11 A. M. There is no fear of the dirt or leaf sticking to the *kapas* as each pod is gathered carefully by a limited number of coolies engaged for the gradual picking of the pods. The whole village under the present method of picking always has a clamour for want of a sufficient number of coolies to gather the *kapas*, because everywhere the fields are quite ready for picking. The wages consequently run high and even in spite of high wages coolies are not to be had. The picking of the *kapas* is thus belated and the consequence is that much of the produce is necessarily left ungathered on the plants and often the standing crop has to suffer, owing to early and untimely heavy showers. The loose *kapas* on the pods is damaged very greatly and the same being marketed with the produce gathered early, spoils the whole lot by giving it extreme dulness and blackness in colour. The picking method now obtaining renders the *kapas* leafy as above stated. Now the dulness of colour and leafiness tend to ruin the quality when the material is placed side by side with clean and clear Broach.

Another improvement may also be suggested regarding the picking. The leaves and the pods should not be allowed to get stark dry and the picking should be made while the leaves and the pods are still green. The stalks of the pods will not be severed while picking and thus the *kapas* gathered will have very little of the leaf in it.

The English markets have a special objection to the leaf in the Coompta, in that, it persistently sticks to the cotton and much of the yarn is injured while spinning. Owing to the leafiness alone, the English markets give the Coompta 20 % less price than they would, had the cotton no leaf in it.

Now how much the picking method is to be held responsible for the deterioration can be seen from the above. Unless there is introduced an improvement as suggested above, the quality is doomed to go from bad to worse and unless those in authority take up the matter seriously and point out to the ignorant ryots their own benefits only if they could take up the more careful and none-the-less economised method of *kapas* picking, the Coompta will have to remain low in the markets.

I have been making my individual efforts to bring the improved method of picking, to bear on as many ryots as I could induce, whenever I could find time but I see no way to get all of them to come to learn the necessity of having recourse to my method of picking *kapas* I advocate as herein above stated *a gradual picking of the fields as the pods open and while the leaves and stalks are still green.*

I hope I need not point out any more of the many disadvantages that result from leaving the *kapas* to open fully and hang on the stalks. Rats carry into their holes the *kapas* that falls to the ground and they remain in the field till they dig out and eat the seeds sown the following year. The injury done to the crops as they come up by the rats is too well-known to need any special mention.

Experiments on Green Manuring and on Nitrate of Soda in Junagadh.

BY

S. H. Vasavada, B. Ag.,

Agricultural Inspector, Junagadh.

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THE importance of the use of dung manure is well known to every cultivator in our districts; and I have noticed more than once that its supply is so limited as to stop many of our cultivators from having resource to the more paying irrigated crops which in the absence of a proper supply of manure would not bring adequate returns. The scarcity of the available dung manure might to a very great extent be minimised if the cultivators cease to use dung cakes as fuel, but here the long standing habits of the people come in the way. But even allowing the present practice of using the dung cakes as fuel the available manure can be easily doubled if the cultivators begin to understand the right method of preserving the waste products of the farm in a properly made pit free from washings, and make use of fine clay, silt, &c. in the cattle byre to soak up the urine which can thus be turned into a very useful manure. The latter practice might safely double his present supply of manure. To add to the present supply of manure which as shown above is quite insufficient, an extensive use of green manure in our irrigated lands that remain fallow during the monsoon is to be desired. A green manure means growing a crop in a field and ploughing it in, during the rainy season, so that it may rot in the soil and serve the purpose of manure. The practice is not quite new to cultivators and old people well remember the resulting enrichment of their soil if a crop is ploughed in before it attains maturity. Recent experiments in different parts of the Bombay Presidency have shown that of all crops used for this purpose Sann Hemp (*Crotolaria juncea*) has been found to be the best, since a well-grown crop adds to a soil as much of manurial value as twenty five loads of well rotten dung manure per acre. It grows very fast and reaches its flowering stage in a month and a half. Its plants grow very high and when ploughed in add more organic matter than *til* (Sesamum), *Udid* (*Phaseolus radiatus*), *Mug* (*Phaseolus mungo*), *Jowar* (*Sorghum vulgare*) and other crops commonly used for this purpose. It moreover grows well in heavy and continuous rainfall and rots very soon and has been found to be the most suitable crop for green manure. In order thus to demonstrate in a very practical manner the many advantages of its use as a green manuring agent I laid out during the year of report a field experiment in two cultivators' field in Balot with the help of Mr. Liladher the *Japti Vahivatdar*, 138 lbs. of Sann Hemp seed were supplied to these cultivators in the month of July and instructions were given to sow the seeds very thickly at the rate of 70 lbs. an acre. The crop grew very vigorously and was ploughed in under my personal supervision with the help of an iron plough in the first week of September. Wheat was sown in these fields after the green stuff was completely rotten in the month of November 1916. The growth of the same appeared to be more healthy than that in fields under local treatment and the final results as shown in the statement below show a net profit of Rs. 12/- per acre in the plot under the green manure over that under the local manurè, which is found to be very scarce. Granting even that there will be little extra profit due to the use of this manure the ready availability of manure material it offers, and that too without any extra trouble of carting and spreading in our well irrigated lands that remain fallow in the majority of cases, is itself a matter of great importance in its favour. It besides might induce the cultivators in course of time to make use of all their available store of local manure which is at present used in these lands, in their *Baret* lands which if lightly manured at the rate of 10 cart-loads per acre would increase very largely under average conditions, the yield of their crops.

This field experiment at the very doors of the people has created a very healthy spirit of confidence among those who have followed it in detail and as a result a very large demand of Sann Hemp seed has been received by me during the presént year and necessary steps have been taken to order out 2400 lbs. of the seeds for green manuring purposes next year.

Another field experiment was undertaken in this direction at Veraval and Kajali under the Patan Mahal. The cultivation of onions is carried on in a very careful and intensive manner in this district but the yield per acre of this crop has been found to range below from fifteen to twenty *khandis* per acre. These figures appeared to me to be too low in view of the richness of soil and the water facilities obtaining in this district and on enquiry I found that the available supply of manure is very small. The growers of this vegetable crop are more or less business men and they are very willing to adopt any means by which their profits per acre could be increased. Under these circumstances I selected three good cultivators and tried a top-dressing of Sodium Nitrate in their fields at the cost of the State during the year under report. The fertilizer did excellently well and fields top-dressed stood as a very great contrast to all the other hundreds of fields in the whole district. Crowds of cultivators were attracted to see this novel experiment in which a very great interest was shown by the neighbouring onion growers. The result as will appear from the statement (II) attached are so convincing and the extra profits so great that there is a likelihood of very great demand for this fertilizer near Veraval next year. But the price of this fertilizer is very high due to the present war and the cost of top-dressing which under normal times should range between Rs. 40/- to Rs. 50/- per acre would come to Rs. 75 under the present conditions. A scheme therefore to offer a partial help to those willing to make use of this fertilizer next year by way of a bonus to cheapen it, as a matter of encouragement in the beginning, is under consideration.

Ordinary cultivators are likely to face another difficulty in the availability of capital at reasonable rates of interest to buy this costly fertilizer which is found to give cent percent profits during the year of report and the question may be solved to some extent by the organisation of a co-operative credit society and a move has already been made in this direction.

A question has also been raised from some corner regarding the possibility of any evil influence resulting from the use of this fertiliser. Though there is very little to be feared from a judicious use of the same, repetition of the present experiment at State expense for three to four years with a view to clear away any such doubts in a very practical manner is under consideration.

There is in fact a very great scope for one to work in this direction. The manurial supply is very deficient in our district and any attempts to demonstrate successfully the most judicious and practical use of a variety of general manures like green manure, oil-cakes, fish, and fertilizers like sodium nitrate and ammonium sulphate in our rich and irrigated crops like sugar-cane, plantains, onions, chillies &c. should, if undertaken at State expense, create a very great confidence in the minds of our ignorant and conservative cultivators.

STATEMENT I.

Green Manuring Field Experiment 1916-17—Wheat.

Plot.	Manure.	Cost of manure (per acre).	Outturn per acre (Grain.)	Gross Return less cost of manure
I*a*.	Green Manure...	Rs. 12-6-6	1140lbs.	Rs. 41-0-6
I*b*.	Town Sweeping.	Rs. 12-0-0	840lbs.	Rs. 28-5-0
II*a*.	Green Manure....	Rs. 12-6-6	1250lbs.	Rs. 46-3-0
II*b*.	Local Manure....	Rs. 12-0-0	1000lbs.	Rs. 35-7-0

The cost of manure included all expenses including ploughing in.

The Local Manure is not available for sale in the districts.

The Wheat was sold at Rs. 1-14-0 per maund.

STATEMENT II.

Nitrate of Soda in Onions near Veraval. 1916-17.

Plot.	Manure per acre.	Cost of Manure per acre.	Outturn per acre.	Gross Return less cost of manure.
I*a*.	12 loads local manure 4 cwt. Nitrale of soda	Rs. 81-6-0	28000lbs.	Rs. 233-10-0
I*b*.	25 loads local Manure.	Rs. 12-8-0	12000lbs.	Rs. 123-0-0
II*a*.	12 loads local manure 2 cwt. Nitrate of soda	Rs. 43-11-0	19,200lbs.	Rs. 172-5-0
II*b*.	25 loads local manure.	Rs. 12-8-0	12,000lbs.	Rs. 127-0-0
III*a*.	12 loads local manure 5 cwt. Nitrate of soda	Rs. 100-3-6	23,000lbs.	Rs. 158-8-6
III*b*.	25 loads local manure.	Rs. 12-8-0	19,000lbs.	Rs. 201-4-0

The Nitrate of soda cost Rs. 18-13-6 per cwt. at Veraval: its normal piece would be Rs. 12-0-0. The onions were sold at Rs. 9 per 800lbs.

In III the field was in excellent condition to start with and the quantity of Nitrate used seemed to lead to an excess of leaf growth.

The Eradication of deep rooted weeds among fruit trees in the Konkan.

BY

Mr. S. M. Shrotriya.

THE urgent importance of the removal of weeds from fruit gardens is not by any means always realised. They are however injurious for two reasons. On the one hand they steal the water which is available in the soil,-rarely too great a quantity in regions like western India where the dry season is very long,-and on the other, some of them, particularly grasses, have a directly harmful effect upon the trees among which they grow. In spite of this, however, it is not at all uncommon to see the ground between rows of fruit trees and vegetable crops full of weeds, and this whenever it occurs, indicates a 'penny wise and pound foolish' policy which is certain at least to result in much diminished returns.

When I took up the management of the Dady gardens at Chimbar near Bombay this was the situation on them. The gardens, full of mango, *Chikoo*, (*Achras sapota*), and pomelo trees, had been leased for five years to a tenant. During this time no trouble was taken to keep the gardens weeded, and they became full of the so-called *dharba* grass (*Saccharum spontaneum*). In October 1914, when I took charge, the *dharba* grass had grown so much as to stand even five to six feet high among the trees and had become a home for jackals, rabbits, and snakes. The roots had gone three to four feet deep in the soil, and the result was that the trees were suffering badly. The mango and pomelo trees were the most affected. They looked unhealthy, had their leaves of a pale green or yellowish colour, and their growth was very poor. Partly as a result of these conditions the stems of many of the mango trees were attacked by the mango borer (*Batocera rubus*). As a result the fruiting capacity of the mango trees was very reduced, and many of them failed to blossom in the following January. Other causes no doubt affected the situation, but the neglected weedy condition of the garden was, I think, the prime cause of the position. The former owner had spent a good deal of money on hand digging of the *dharba* grass, but with no appreciable result.

The method I adopted for cleaning away these deep-rooted grasses and other weeds was suggested by Dr. H. H. Mann of the Poona Agricultural College who visited the gardens in March 1915, and as it has been very successful I venture to give a somewhat detailed account of my experience.

The *dharba* grass which had grown five or six feet high was cut close to the ground with the ordinary sickle in March 1915. The ground being claye, dry, and cracked at that time, cultivation with the ordinary Konkan plough was out of question. A Ransome's C. T. 2 plough was, therefore, obtained and this ploughed the land fairly well considering that it had been untouched for five years. After ploughing, the mango plots were harrowed once a fortnight till the first showers of rain in June 1915, when it was again ploughed with Ransome's C. T. 2 plough. At this time this plough worked splendidly. It cut the deep roots of *dharba* very well and exposed them to the sun. After ploughing, the land was once harrowed and *sann* hemp (*Crotolaria juncea*) was thickly broadcasted and the seed covered by the ordinary plank. The *Sann* hemp grew rapidly and shaded the ground completely so that the *dharba* grass was largely smothered. It appeared, however, but never, during this year, reached more than eighteen inches high anywhere.

The *Sann* hemp was ploughed into the land in September 1915 with the C. T. 2 plough, and thus the roots of the *dharba* were cut again. After allowing the green matter from the *sann* hemp to rot for two to three months, the ground was simply harrowed twice a month, and again ploughed with the C. T. 2 plough in June 1916. This cycle of cultural operations, coupled with the sowing of *sann* hemp at the commencement of the monsoon is now being regularly repeated, and the method has shown itself both simple and economical, and in addition, has worked out splendidly in checking the growth of the *dharba* grass and similar weeds.

The advantages of this method are many. As already stated, it is very simple and economical, and within the reach of every cultivator. The total expense, including the cost of *sann* hemp seed is not more than Rs. 12-8-0 per acre for a man who owns a Ransome's C. T. 2 plough. The *sann* hemp by its rapid and vigorous growth quickly shades the growth and smothers the weeds. The effect of the plants ploughed in as a green manure is very marked, and the stickiness of the soil is considerably reduced. No hand weeding is necessary so long as the *sann* hemp is growing even after it is ploughed in if regular harrowing is done at short intervals.

The effect on the mango and pomelo trees was marked even in the first year of the experiment. The vegetative growth of the trees was profuse, and the colour of the new leaves was dark green. The mango borer largely disappeared, and the trees blossomed profusely in January 1916. The crop was afterwards small, it is true, owing to a very bad attack of mango jassids when the flowers were opening, and this reduced the return from my trees from Rs. 2,000 to Rs. 175. The latter amount was obtained from fruits produced from the second blossoming in March, and this blossoming was the direct result of the *sann* hemp manuring of the previous year. In 1917 I obtained Rs. 750 from about fifty trees, almost all from the plots which had enjoyed the benefit of the treatment I have described. It is therefore obvious that the mango trees are being progressively improved by the treatment.

Since this method of checking the growth of *dharba* grass in the plots of mango has been adopted, there has been a considerable decrease in the number of moths (*Ophideres fullonica*) which damage pomelo fruits and are one of the worst enemies of that crops. The pomelo fruits are punctured by this moth during the rainy season, and I attribute the decrease in the loss on this account to the increased cleanness of the garden due to the removal of the *dharba* grass. The old method of dealing with these moths, which is still practised by the fruit growers, is to burn them down with torches. In the rainy season of 1915 by using this method, I used to destroy from 75 to 100 moths each night; now I do not get more than ten to fifteen. If my belief is right, the extension of the treatment adopted among the mangoes ought to remove almost entirely the trouble with these pests.

Another improvement which has taken place at the same time, and possibly as a result of the treatment, is the disappearance of the black spots on the surface of the fruits caused by *gloesporium*, and of the disease called in Marathi पांढरारोग which affects the pulp both in the raw and ripe condition. In 1915 more than fifty per cent of the fruits were affected by these diseases; in 1917 not more than ten per cent were damaged. I do not know what is the connection between the treatment and this result, but the result is a very happy one.

So far I have dealt with the methods I adopted in eradicating *dharba* grass in mango trees. I firmly believe that other kinds of fruit plantations such as *chikoo*, orange, lemon, pomelo &c. will benefit considerably from similar treatment. It is true that when a plantation is thick as with these trees, ploughing would be difficult, but a lighter implement like the planet junior hoe might be used.

Silage making on the Gokak Canal Farm.

BY

T. S. Swadi, L. Ag.

Superintendent, Gokak Canal Farm.

SILAGE is green fodder preserved in a succulent condition by artificial means. It is generally prepared in pits or buildings which are called silos. A silo may be in the form of a *kacha* pit that is to say, a simple hole in the ground, or it may be a pit built up carefully with stone or brick. Further it may be a building of stone or brick above ground in which case it is termed a stack silo. But a specially built pit appears by far the best, taking the opinions generally held throughout those parts of the world where silage making has developed into one of the principal methods of preserving fodder.

Silage can be prepared out of various crops and grasses. The following crops have been very successfully used for this purpose:—maize, *sorghum* (*Jowar*), Cowpeas (*Chavali*), clover, green oats, and grasses.

In India excellent silage has also been made from *sorghum* (*Jowar*) at Allahabad, from grass at the Tegur Farm near Dharwar and from maize on various government farms both civil and military.

The essential points in successful silage making are, firstly, a good pit into which water will not have access either from below or from the sides. It should equally be protected from rain water. A pit to suit the above conditions has been built on the Gokak Canal farm measuring twelve feet in depth and ten feet in diameter at a cost of Rs. 120. Secondly there should be good packing especially at the sides where there are greater chances of loose filling. To accomplish this, the fodder is chaffed into small pieces, say half an inch long, by the chaff cutter and regular trampling is done when the pit is being filled. Besides after the pit is filled, the heap is weighted with stones and then plastered up with mud over a layer of trash or grass. The purpose for doing this is to exclude air and prevent decomposition. For economy in silage making, it is also equally desirable that tonnage and quality should be aimed at. It must be borne in mind that by making silage, the bulk of the fodder is not increased nor is the quality of any inferior fodder improved and hence we have to try and obtain the maximum outturn and the most nutritive value out of the crop we are using. If we use a young and very succulent crop, there is not only less yield but the silage turned out is very sour, not to speak of the poisons which some of the cereals like *jowar* might contain. Again a crop which, after full growth, has become woody and indigestible is not in the most suitable condition for silage making, and if the late crop is partially dry the addition of water might be needed to provide the moisture necessary for the fermentative changes which must take place. In short the crop should have attained full growth, but should not have ripened off if it is to be in the most suitable condition for silage making.

In the case of *jowar* and maize the above conditions are best fulfilled when the ear heads contain grain in the dough stage, and the crop attains this stage when the maize is two months old. The *sadgar* variety of local *jowar* is three months old on the Gokak Canal farm when it is in the most suitable condition.

In the preparation of the silage, there are again two methods. One consists in filling the silo as rapidly as possible,–the other in filling slowly as material becomes available. By the first method the air is excluded immediately and the fermentation goes on for a longer time and sour silage results. In the second method, the heap is filled gradually or at intervals so as to admit a very limited quantity of air. This produces sweet silage. On the Gokak Canal farm sweet silage was made, by filling the pit (which holds nearly 30,000 lbs. of chaffed green fodder) in four instalments at intervals of four to five days. This interval will, of course, vary with the climatic conditions. A temperature of 130°F. was reached at the sides of the pit in which case excellent sweet silage was obtained. The following figures, from McConnell's Agricultural Note book, give an idea of the effect of different temperatures on silage making.—

Under 120°F. – Sour silage.
120° – 130° – Slightly acid.
130° – 140° – Sweet green silage.
140° – 160° – Sweet brown silage.
Over 160° – Burnt.

The activity of the fermenting bacteria referred to consists in breaking and converting the carbohydrates garadually into sour acids viz. acetic and lactic acids. In the sweet silage the activity is stopped when the carbohydrates are just changed into the sugary stage and the silage turned out is sweet. The temperature tests have preferably to be taken with the help of a thermometer if silage is to be prepared to any particular standard, otherwise putting the hand into the oxidising heap might suffice for rough purposes.

I need not discuss here the advantages of making silage. These are now recognised in every country where green and succulent fodder is not available otherwise throughout the year. Here in western India we have a typical condition where silage will be of immense value. I consider in fact that not only is there immense scope for silage making here, but its introduction and extension is an absolute necessity if there is to be any chance of improving the condition of the cattle.

The following tabular statements show the results of making *maize* silage for a number of years at the Gokak farm :—

I.

Year.	Quantity of green maize used.	Quantity of silage obtained.	Value of Green fodder.	Expenses.	Silage obtained per rupee.	Wastage.
1913–14.	20,000 lbs.	11,900 lbs.	Rs. 70	Rs. 9	150 lbs.	
1914–15.	20,000 lbs	12,500 lbs.	...	...	...	2%
1915–16.	28,000 lbs.	16,800 lbs.	Rs. 68½	Rs. 24½	180 lbs.	4%
1916–17.						4½%
(*a*)	22,800 lbs.	18,115 lbs.	Rs. 55	Rs. 22	235 lbs.	...
(*b*)	9,800 lbs.	7,200 lbs.	Rs. 30	Rs. 9	183 lbs.	8%

All these lots except 1916–17 (*b*) were made in a stone lined pit. 1916–17 (*b*) was made in a *kacha* pit.

The pits were filled each year in August or September. The lots in 1914–15, 1915–16, and 1916–17 (*a*) were opened in December. In 1913–14 and 1916–17 (*b*) the lots were opened in March.

The 1916–17 (*b*) pit was filled with maize after removal of the cobs.

II.

(*Percentage of Silage obtained in green maize used.*)

1913–14 ...	59 per cent	Average 64.4 per cent.
1914–15 ...	62·5 ,,	
1915–16 ...	60 ,,	
1916–17 ...	76 ,,	

III.

Analysis of Silage obtained from maize (calculated to a basis of 75 per cent moisture).

	Ether Extract	Protieds.	Digestible Carbohydrates.	Woody fibre.	Ash.	Nitrogen.	Lactic acid.	Acetic acid.
	%	%	%	%	%	%	%	%
1913–14								
(sour silage).	0·76	2·25	11·35	8·00	2·64	0·42	...	...
1914–15								
(sweet silage).	0·51	1·72	2·32	17·50	2·88	0·27	0·14	0·12
1915–16								
(*a*) (sour silage).	0·75	2·28	11·51	7·68	2·78	0·36	...	...
(*b*) (do. after removing cobs.)	0·45	1·32	10·79	9·24	3·20	0·21	...	...
1916–17								
(*a*) (sour silage).	0·70	0·34	12·22	9·16	2·51	0·05	0·55	0·09
(*b*) (do. after removing cobs.)	1·02	0·85	14·14	6·99	2·00	0·13	0·42	0·11

The fodder used in 1914-15 was inferior, from a dying crop owing to water-logging.

IV.

Starch equivalents of maize silage (calculated in 100 pounds of dry matter).

1913–14	... 61·39 lbs.
1914–15	... 21·49 ,,
1915–16	
(*a*) whole crop	... 62·06 ,,
(*b*) crop without cobs.	... 52·58 ,,
1916–17	
(*a*) whole crop	... 56·68 ,,
(*b*) crop without cobs.	... 69·34 ,,

Prospects of Rural, Co-operative, Improved Implement-Hire Societies in the Bombay Karnatak.

BY

V. R. Dharwadkar, L. Ag.

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SATISFACTORY as has been our progress in credit co-operation in the Bombay Karnatak, we should not forget the fact that we have yet to develop the more important branches of agricultural co-operation such as co-operative purchase, sale, dairying, cattle breeding and so on : and that the burden of bringing about a rapid improvement of the agricultural industry of the country through co-operative organisation rests on the people themselves or rather their natural leaders. It is in Europe that co-operation was first started and it has made rapid progress during the last forty years. Every country on the continent recognises the power of co-operation as applied to agriculture. Then in country like India where eighty per cent of the population consists of agriculturists the adoption of important type of agricultural co-operation must have good results.

Since the introduction of the agricultural department in the southern division of the Bombay Presidency it has been proved by facts and figures that certain implements like iron ploughs, wheat threshers, sugarcane mills and *gul*-boiling pans are much better than those in common use. With these facts in view it would appear probably that in the introduction of these implements we have a remarkably useful field for co-operative organisation. Recently, since the agricultural department has taken up the work of demonstrations of ploughs and other implements at various centres in the districts the advantages of improved ploughs in removing the existing weedy condition of the land over hand digging, of the wheat thresher over tedious bullock treading, of improved sugarcane mills and Poona *gul*-boiling pans over the local ones both in the saving of time and in economy, are being highly appreciated.

During these two years in such demonstrations on a small scale a sum of Rs. 568 was recovered as hire on implements worth Rs. 3640 or nearly sixteen percent interest on the capital invested. From this it will be seen that there is a great demand for implements for hire in the Karnatak. Besides this business if carried out properly would pay a good percentage of interest on the capital invested in it. In the calculation in the above statement no allowance for depreciation is shown.

There is a class of cultivators, namely those in a medium position, who wish to use improved ploughs for improving their lands. But unfortunately they have not got the ready money to pay for the implements. Besides they want the implements only for short periods. Thus they find it advantageous to hire the implements rather than to buy the same. Under these circumstances it seems necessary to keep a number of implements for hire at the proper season through the medium of independent co-operative implement-hire societies. To quote an instance of the desire of the agriculturists to form such hiring institutions I may say that just after a recent plough demonstration at Kalasur a village in the Haveri Taluka of the Dharwar district we had a meeting in the village *chavdi*. Several agricultural points were discussed. The Deputy Director of Agriculture S. D. made a proposal to have common plough in the village to be kept on hire under the management of the local committee. On the spot a sum of Rs. 30 was subscribed and it was decided to buy one C. T. plough and keep the same for hire. This is not a solitary example that I am quoting for very shortly there will be about thirty rural co-operative implement-hire societies in the Haveri taluka alone.

The Agricultural Department by actually hiring out the implements during the last two years has shown how far this line of business if properly managed would be profitable. Thus it is clear that if the work of hiring implements is undertaken by co-operative effort, they will not only have done good useful work but have properly invested their capital. The work requires careful management. A trained *mukadam* from some Government farm should be engaged temporarily for four months by a union of say about twenty five societies to look after the proper working of the implements kept on hire by these societies. He will show the right use and be able to guide the hirers if they are unable to use them. The chief thing to be looked to in these things is that the implements should not lie idle. The season of ploughing is only limited. It requires pre-arrangement to let the plough to one after the other without any idle days in the middle. This line of work has been properly undertaken by the Athani Agricultural Association. The credit is due to Mr. Mangasuli, the secretary of the Association. He has, with a subscribed capital of Rs. 300 invested in purchasing implements, recovered a sum of Rs. 140 as hire in return.

Different tracts require different kinds of implements. The *malad* tract requires a large number of sugarcane mills and *gul*-boiling pans. The black soil of Savandatti and Athani and the sugarcane tract of Chikodi, Nipani and Hukeri require C. T. and Gallows ploughs or their equivalents. The implements to be bought and the rate of hire to be charged and other details are minor points which can be worked out in consultation with the officers of the Agricultural Drpartment by such societies.

Ticks and Measures for their Eradication.

BY

V. R. Dharwadkar, L. Ag.

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IT is common knowledge to the stock owner, that cattle feeding upon tick infested land quickly become covered with vast numbers of these pests. To cite an instance, a small herd of six animals at Ranebennur was examined singly by passing them through a door where I was standing, and they were found so badly infested on the neck and shoulders that it was impossible to touch these parts with a finger without touching a tick. It is obvious that so many ticks must deprive the animal of an enormous quantity of blood.

It is well known that to bring profit to the farmer, all his cattle must be well conditioned: and this is practically impossible when they are infested with ticks. It is believed that ticks are only found on poor animals, the inference being that they prefer to attach themselves to impoverished stock. This is only partially true, the fact being that the ill condition of the animal is in very many cases caused by the ticks.

It should be noted that when the ticks first attach themselves they are so excessively small as to be difficult to find, even when a careful examination is made. It is only some days afterwards, when they have sucked the blood of the animal that they become sufficiently distended to be easily noticeable. Hence it is that the casual observer is likely to overlook the presence of young ticks, and is led to entertain the idea that they are not found on animals in good condition.

Ticks may be divided into two groups (1) flat ticks and (2) round ticks. The flat ticks do not as a rule attach themselves to cattle and are distinguished from the round ticks by their habit of living in the crevices of the walls of cattle byres from which they issue at night to suck the blood of their hosts. The round ticks form the great majority of those which are found on cattle and other domestic animals like dogs. All ticks are blood sucking animals, and feed exclusively on a living host.

All ticks pass through four stages. When the eggs are laid the female tick dies, having fulfilled its life mission. The number of eggs the female ticks lay varies with the species but about 2000 to 18000 eggs are laid in several lots. Ticks are very hardy and in their intermediate stages can stand starvation for long periods even for more than a year.

With these preliminary notes and remarks I will point out methods of dealing with the ticks which have been successfully tried at Tegur and Ranebennur.

If there be one or two animals the ticks may be picked off or scraped off with a small piece of tile. If the infection in a stable is great a blast lamp such as is used by painters for removing paint should be used in the cattle byre. The stove should be given full swing and the flames should be allowed to enter all the crevices of the byre. The cattle should not be tied in the infested place till all are eradicated. On the fourth or fifth day after treatment almost all the eggs will have hatched. Again the stove should be used. If necessary a third treatment should be given. Then the walls should be white-washed. The floor should be dug four to five inches deep and cotton stalks spread on the same and burnt. During this operation the cattle should not be tied in the byre. The ticks on the cattle can easily be removed by smearing the cattle with the following mixture: (1) one bottle of sweet oil. (2) 5 tolas of *dambar* or tar (3) 15 tolas of kerosene oil. If this is done twice in a week all ticks of the body will disappear. This blast lamp mentioned can be had at Rs. 15 from the Divisional Inspector of Agriculture, Southern Division, Dharwar.

Notes on the Toddy Palm in Western India.

BY

J. D. Edal Behram.

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THE following notes, put together as a result of experience in the conditions of Western India may serve to give some ideas as to the methods of cultivation which must be adopted to make the growing of the toddy palm a success. The climatic conditions in this part of the country are peculiar, and differ completely from those under which the toddy palm is so extensively cultivated in Bengal.

Soil—In the Thana district and in Gujarat the toddy palm flourishes in any well drained soil, but by far the best results are obtained in what is termed *gorat* or *goradu* soil. In sandy or even *murum* land, the plant does not refuse to grow, but the development is very slow and the outturns are poor both in quantity and quality. In black soil the trees thrive well, and the toddy is richer than that obtained from *gorat* soil. The quantity is however smaller. In the so-called *besar* soil, the quantity is very constant throughout the season.

Preparation of the soil.—It would be hazardous to start a plantation on grass land. All the grass and stubbles should be removed, and to give the young toddy plants a good start it would be well to utilise a soil, even when unmanured, after it has been cultivated at least three seasons. Many plantations in Gujarat have grown up naturally without any particular care and without special preliminary preparation of the soil. The toddy palm in most cases as on road sides, grows spontaneously and very often no attention is given to it until it becomes of an age suitable for tapping.

Planting.—The toddy palm is not propagated from seedlings or small plants. The seeds are directly sown in the ground at the proper distance. In the hot wheather when the fruits of the tree fall, they are eaten by foxes or other animals. The seeds passed out by them are the best available for planting and it is said that the trees propagated from such seeds turn out exceptionally sound and healthy. Generally three seeds are sown at a distance of ten to twelve *hats* (one *hat* is about eighteen inches) both ways. All the three seedlings are allowed to grow till they are twelve inches high and then one of these is removed along with its seeds and only two kept. The remaining two seedlings are said to merge into one another so as to give finally a strong plant.

There is another source of seeds for the propagation of the toddy palm. The fruits are first eaten by goats and during the process of rumination the seeds are thrown out. These seeds are very good for planting and germinate very early. The seeds are planted in August and take about twenty days to germinate. For every tree required two seeds are sown.

Manure and Manuring.—To this plant manure is not at all given to start with in most districts. The manure generally employed is farmyard manure. In its absence and in cases of absolute necessity castor oil cake is employed but the cost is considered to be almost prohibitive. Manure is given only after the trees are four to five years old. The reason for not manuring earlier is that the plants are likely to die in their earlier stages of heavily manured, if in the absence of rain irrigation is omitted.

In some districts manure is given to start with. While the seed is planted two handfuls for every spot planted are given. Again in certain areas manure is spread in June on the ground and soon after when sufficient rain has fallen, the ground is ploughed with the country plough and then the seeds are planted as described above.

Irrigation. In toddy palm cultivation there are two sides to the question of irrigation.

If when the plants are young they are irrigated, they have to be irrigated always. The question then arises as to how the plants can be kept alive till the next rains if irrigation falls. This not unfrequently happens, and in this case a good mulch has to be maintained throughout during the rains and the natural moisture thus conserved. This is done by the country plough as soon as the weather sets fair during the rains and the upper soil crust looks dry. The ploughing is done three or four times as time and opportunity permit.

The tendency on the part of the cultivators is, not to irrigate at all, because they do not want to run the risk of a planatation failing should the water be unavailable during the hotter parts of the year. Their experience again shows them that unirrigated trees yield a better quality of toddy juice than those that are irrigated but the latter give a much greater quantity of juice. Again the irrigated trees become fit to be tapped three or four years earlier than the unirrigated ones.

Tapping.—Practical experience is always the better part of success in agriculture and it is only experience at present that can determine when a tree is suitable for tapping. There are some preliminary operations that have to be done before the actual operation of tapping is performed. As soon as the trunk of the tree is three feet above the ground, every year the side leaves are removed by means of a hatchet the top ones being kept always intact. The leaves are not removed in a circle round the girth of the tree but from year to year they are removed alternately from the flanks. Thus if one stands opposite to a tree and calls his right hand side the right flank of the tree and the left hand side the left flank of the tree then if say four half right spirals of leaves are removed in the present year then the remaining four left half spirals of the tree are removed in the next year, and this process of removing leaves from year to year is said to give better girth to the tree than the process of removing along the whole circumference of trees each time.

Ag a general rule, tree becomes mature enough for tapping when it is seven to eight years old. This is the case provided it is irrigated all throughout the period. Unirrigrted tress generally take from ten to twelve years to grow mature enough for tapping.

The length of time during which a tree may continue to yield juice has not been observed, but the practice is to draw out juice from a tree for three months, and then eighteen months are allowed to elapse before the next tapping is made. By this time the tree again grows in height and incisions are made at a different place. The procedure followed in Western India during the three months that juice is drawn from a tree is as under :—

The tree is tapped for the first five days that is to say, juice is collected for these days and no fresh incision is made on the fifth day so that the juice is not obtained for the next day. The tree is allowed rest for the next five days and so on. After five days' rest again a fresh incision is made, the juice collected for the next four to five days and rest given for an equal or less period according to discreon. During the period of ninety days that the tree is under process of juice extraction, it is so tapped that the tapping and juice collecting days takes place on sixty days.

The general practice is to tap trees in the monsoon and the young trees in the cold and the hot weathers. The reason given for this is that the young trees in the monsoon if wounded are more liable to the attack of borers than the old ones. The wounds are likely to occur in the process of removing leaves.

In the operation of tapping all the leaves are removed round about the spot where an incision is to be made. The operation is made about three feet below the top of the tree. A sort of very shallow sloping drain is made and then one or two incisions are made separately and in those, two small leaflets are inserted which so to say, make a canal for the toddy juice to flow into the receiving pot. The juice comes in drops and is collected.

Every time the toddy tapper goes up to bring down the accumulated juice he removes with a very sharp chisel made for the purpose an extremely thin slice of wood along the incision.

Outturn.—If the trees are irrigated the average outturn is twelve to thirteen maunds during one period of tapping and taking 200 trees to an acre the average is 2500 maunds per acre in practice. These figures apply to *gorat* soil. In poor soils or others not suited to this plantation if the trees are irrigated while under the process of juice extraction the outturn is seven to ten maunds.

Cost of Cultivation.—I have not met a single planter who has ever calculated the cost of planting and raising per acre. No body could give me any exact figures but the following are some approximations.

We have seen that two hundred trees are planted on an acre. The trees in most cases grow of their own accord and no body, so far as this plantation is concerned, takes any special care after this, but a rough idea could be worked out from the following figures :—

(1) It costs 4 Rs. to plough one *bigha* with the country plough in Gujarat.

(2) 20 to 25 cart-loads of farmyard manure are given per acre and one cartload weighs 35 maunds.

While juice is being extracted from trees, three tappers have to be maintained for every hundred trees. One of them who is an expert, is a head of the other two and draws Rs. 20 per month. The other two draw Rs. 15 each. Tapping a *khajuri* tree is an art and the outturn very much depends upon the tappers who are known as '*Tawadas*'. These men have generally to be employed for three months that the trees are yielding juice. One guard is maintained for 100 trees. He carries salary of Rs. 8 to Rs. 10 per month.

When juice is drawn from trees they are watered for the three or four months that the juice is drawn from them. Watering is given every four days and the cost per fifty trees comes to about a rupee. The plantation is irrigated with a '*Ramario*' mhot. For this three men are necessary, one driver, one water director, and a man to look after the filling and emptying of the *mhot.*

Adulteration of the toddy.—By far the most common adulterant in use is water. This is generally used to increase volume and add thus to the profits.

If sometimes all the toddy is not sold, it goes sour the next day and thus becomes unfit for drinking, then in order to disguise the bad taste, red sugar is added and then the toddy is sold as fresh stuff.

Ashes from lime kilns are added to prevent toddy getting sour, and also to make it appear frothing at the top. Another trick to show frost on the surface is to add an emulsion prepared by rubbing *Arithas* (soap-nut) in water. *Arithas* are generally used for washing wooden and silken clothing by the poorer classes of people and yield a soapy lather when worked up with water.

Some toddy drinkers prefer a bitter taste in the toddy. In order to impart a bitter taste to toddy quinine is often added.

Notes on the products of the Harar Plateau Abyssinia.

BY

Lt. D. S. Carlett.

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THE great plateau of Harar has an elevation of 6,000 feet above sea level. It is about 200 miles from the Gulf of Aden. To the East lies British and French Somaliland.

The temperature varies but little during the year, being on an average 24 degrees Centigrade during the day, and 14 degrees at night. There is never any frost but occasional hail storms do a certain amount of damage.

The rainfall is variable, in some years approximately 30 inches fall in others 60 inches. The rains start in March or April with occasional showers, increasing in June, July, August. In the latter two months the days are cloudy with heavy mists in the morning. The rain is never very heavy, rarely descending in the torrential downpour of the tropics.

The winds are mostly North East, and South East, according to the season. Cyclonic gales are never known.

In October and September there are a few showers, and from thence onward till April it is practically dry.

Population.—The plateau is under the rule of the Abyssinian Governor of Harar, and administered in a feudal manner by his chiefs and their soldiers. Abyssinians themselves rarely perform manual labour. The land is divided into that belonging to the Government and held in lease by the Mussulman population of Gallas, and by freehold obtained by the inhabitants of the town–called Hararis, and by a few foreigners from Greece and the Levant.

The villages of circular, mud walled, poorly thatched huts are dotted about over the entire plateau. The people are poor in the extreme and there is no attempt at sanitation in the villages, where the communal life is ignorant and primitive. The villages of the savage tribes of the Sudan are infinitely superior in these conditions.

The Gallas are willing labourers and require only a small wage. With but little trouble they are capable of becoming intelligent and regular workers. They are docile and tractable, and require only a just Government and encouragement to develop into good and industrious cultivators.

Soil.—On the hill tops the soil is poor and stony, as there are no forests to create humus, and the rains have washed much of the surface soil down into the valleys. On the hill-sides a rich black soil is found which produces excellent crops. The hills are low and rolling, save for the higher rocky ranges which encircle the plateau. A short turf is found on the hill-tops which affords good grazing during the rainy season. These grazing grounds could be greatly improved by clearing the scrub which in places take the place of the pasture grass. No fodder appears to be specially grown for the herds of cattle, sheep, goats, mules, and donkeys which are grazed on these common grounds.

The valleys contain a heavy red loam soil very deficient in humus, but when well cultivated and manured, capable of producing crops of a high standard. In other parts the soil is poor and stony, containing an excess of lime.

Cultivation.—The cultivation by the natives is exceedingly primitive. Inadequate, wooden ploughs drawn by small bullocks scarcely scratch the surface and do not eradicate the deep-rooted grasses and the weeds, which are a great past owing to the fact that the land is never ploughed and is left fallow after the harvest, so that all weeds seed themselves. The instrument in general use for turning over the soil is an ironshod, stout stick four and a half feet long, weighted with a circular, pierced, granite stone at the top. With these tools two men work together, turning over the soil and the sods to a depth of four or five inches. This is better work than that done by the plough but an extremely slow form of labour. Another favourite form of instrument is a light spade with a short handle turned at an angle of forty five degrees an apparently most awkward implement to handle, yet the people appear to use it well and quickly for weeding and hilling-up maize and *sorghum*. Hoes, or the mattocks commonly used all over India and Arabia are unknown, and when introduced will not be used.

Grain is scattered broad-cast and very little attention is paid to further cultivation.

Irrigation is rarely resorted to for grain, the limited supply being utilized for coffee and vegetable gardens.

The harvest is in October and the usual native methods are employed.

Manure is rarely applied to grain fields.

Irrigation.—Unlike other Eastern countries very little importance appears to have been attached to irrigation, and no remains of schemes of any size are to be found on the plateau. This is all the more strange seeing that there is a plentiful supply of water from rivers and streams which runs to waste during the dry season by which a second crop might be cultivated.

What irrigation thers is, is employed for coffee during the dry weather, but as no reservoirs are made at the water-heads, and no proper channels cut, much of the water runs to waste during the night or in the natural water-ways that the stream has cut for itself. Nor is there any system of proper distribution or supervision, everybody taking as much as they can and quarrelling for their share.

Transport and Markets.—There are practically no roads at all in the plateau. The main route from the town westward to Dire Daoua a town created by the French at the base of the plateau, is thirty miles in length. Originally a cart-road, it is now impassable for such ; all bridges over the numerous ravines and rivers having been washed away and the state of this neglected road in rainy weather makes it difficult for even animal transport. The rest of the plateau is cut up by rough little lanes from village. These are bordered by *Euphorbia*, which is used together with *Cactus* for boundary hedges.

Practically all transport of grain and coffee is done by donkeys and to a lesser degree by mules. Camels are rarely used as the climate does not suit them, and native porters only for light articles.

The making of this main route into a good motor road would involve but little cost and would open traffic to the railhead at Dire Daoua. The Franco-Ethiopian Railway, running from Adis Ababa to Djibouti, is the main artery of the country, but the rates are high and the passage slow. The customs levied in Abyssinia are such as to discourage trade.

The question of markets for produce remains to be seen. The coffee has a ready market in Europe and grain might also find a suitable market there as from Hourah can be extracted a high standard spirit.

Local markets are limited, as Djibouti only requires a limited supply, and Aden in the future should be self-supporting when communication with the interior is opened up.

Cereals.—In these lie the bulk of the wealth of the Harar and of its value to the Abyssinian Government, which requires much grain for the support of its large army, which represent the mass of the governing nation.

Sorghum. (*Dourah*) This is the grain most commonly cultivated over the whole plateau. Only one small-grained, indigenous variety seems to be used, resembling the common red *dourah* of Egypt. The introduction of some of the superior white and yellow *dourahs* of the Sudan might produce good results. The *dourah* is sown broadcast in April and May and makes very poor growth when young as the result of the bad preparation of the soil and lack of manure. The land is sown year after year with the same crop no idea of rotation being understood by the Gallas. It is subject to Rust, Aphis, and Stem-borer.

Where soil is good the stalks run up to ten feet and provide good leaf fodder for cattle. The weight of crop reaped under present conditions is naturally only a medium one. But it is better than the average crops of the Deccan where the soil is really poor, but it is not nearly so good as those of Egypt or the Sudan.

Maize. Again only the common variety of Maize is sown and the same applies to this crop as to *Sorghum*, save that it is sown in rather smaller quantities and generally where the soil is richer.

Millet. This is not grown in large quantities and is reserved for the richer classes.

Barley. A considerable amount of this is sown broadcast and although giving a fair yield the grain is poor.

Wheat. This is grown in lesser quantities and yields a fair crop of medium grain.

Linseed, *Kurrakan*, safflower, *Teff* and several varieties of smaller grain used for their special flavour in cakes etc. are cultivated with somewhat greater care.

Various Products. Cotton.—There is an indigeneous plant of free growth but poor lint, which is cultivated in small quantities for local spinning for the weaving of native cloth. But during the Egyptian occupation, *Ashmouni* cotton was introduced from Egypt, and some of this is still in existence and yields a fine staple.

Sown in June the cotton is harvested in the dry weather of November and with encouragement and machinery this crop should undoubtedly prove a great source of wealth.

Sugar.—Cane grows well where there is water for irrigation but the sugar content is not known. It is only cultivated for eating the cane ; sugar is apparently never extracted.

Undoubtedly there is a great commercial opening for Beet-sugar in the plateau. At present Abyssinia imports the whole of its sugar supply. A Greek cultivator has informed me that some years ago he imported seed of sugar-beet from France and that the result were extremely satisfactory. The beet grew luxuriantly and quickly, the smallest roots weighing seven kilos (seventeen pounds) and the largest fifteen kilos (thirty four pounds). The sugar value was not obtained but the leaves and roots formed a valuable cattle food. This crop could, of course, be largely grown by the natives during the rains.

Tobacco.—This crop appears to grow well though but little attention is paid to its cultivation and still less to the curing, with the result that the leaf is of very poor quality. The introduction of American, Turkish, or Sumatra varieties and a factory for air and flue curing would undoubtedly form an industry. It is at present used, in conjunction with an imported leaf, in the manufacture of cheap cigarettes for local consumption.

Potatoes.—These grow extremely well and are cultivated in the drier districts but only to a limited degree as the demand is small. The tubers are small but are of good quality and could be improved by the introduction of new varieties. Sweet-potatoes are grown in much greater quantities, all over the plateau, the tubers being large, white and very sweet.

Onions.—These are mostly grown by the Arabs and produce good crops in the drier districts.

Legumes.—Peas and beans are cultivated in a small degree, but the many varieties of pigeon and cow pes, gram, ground nuts etc, so common in India are not cultivated.

Chillies.—These form an important part of the diet of the Abyssinians and are grown in any spare space amongst the crops. This sums up the common products grown by the Gallas all over the plateau, the remaining products are cultivated mostly by the Hararis, Arabs, and foreigners in the valleys around the town of Harar.

Coffee.—This forms the most important product on account of its demand in Europe and the fact that it can withstand drought and the attacks of locusts, an immunity it shares with *Kat*. The attacks of locusts, do not occur every year, but when they do arrive they make considerable havock with the cereals, vegetables, and fruit trees, especially oranges. They arrive during any dry spell from the dry districts which surround the plateau and leave again before the rains break. Abyssinia has been identified as the home of the coffee, from thence imported into Arabia. The present cultivated coffee is descended from these indigenous plants, no other varieties having been imported nor any attempts made at improving the plants by seed-selection or plant-breeding. The cultivation by the Hararis and Arabs is very superficial. The plots are rarely more than half an acre, scattered about the country, but more often only in plots of forty to fifty trees standing on terraces in the midst of other crops. The land is prepared by taking away all the good surface-soil to a depth of three or four feet and banking this up Then in the hollow of poor sub-soil, holes six feet apart are dug for the young plants. Year by year the banked surface-soil is gradually returned to the plants, with the idea of causing the roots to become so deep-rooted as to be drought-resisting.

The young plants are shaded with branches at first, but no permanent shade is attempted, such as bananas, or pigeonpea, to carry them through the first four years.

The plants begin to yield at the fourth year.

The result of close planting is that the trees soon run up to twenty feet or more and have to be picked with the aid of ladders.

The trees are never pruned, with the result that the close foliage renders the lower branches unproductive and induces the spread of disease. The idea of not pruning appears to be to give the plants shade and protection from the hot sun during the dry weather. In many districts the coffee is said not to grow owing to wind and exposure. The growing of suitable leguminous shade-trees as practised now in most plantations in India, Ceylon, and Java has not occurred to the cultivators, and the coffee is grown entirely without shade in a treeless country.

The plots are kept fairly well weeded and occasionally manured with animal dung, ash, and household refuse, and are irrigated where possible during the dry weather.

But many of the plots are in such a neglected state that the trees appear yellow-leafed and full of dead branches from lack of cultivation and manure.

When disease appears, no attempt is made to check its spread until the whole plot gradually succumbs. I have pointed out the spreading disease to an intelligent owner and advised him to coppice and burn all disease trees thus allowing the new shoots to come up, this being the simplest way of getting rid of this disease which would otherwise have to be sprayed. Nothing at all has been done by the owner.

The worst enemy of Coffee the yellow-fungus-leaf disease (*Hemileia*) does not appear to be present at all.

The most destructive disease on the Coffee of Harrar is a spherical, brown scale-insect,* which covers the under sides of the leaves and shedding its ' honey-dew, on the upper surface of the leaves produces the black fungus. Large plots are killed out by this pest, which I have not been able to identify. The green, oblong-scale-insect (*Lecanium viride*) is also present in a lesser degree. A brown leaf-fungus and ' die-back ' of the branches is also found but apparently doing no great damage.

The main crop is harvested in October and November after the rains, although a certain amount of berry ripens all the year round. The berries are placed in sacks for a few days in order to complete the ripening of any unripe berries. They are then dried in the sun, after which they are husked by women in native pounders, no machinery being employed.

The bean is oblong and very irregular in colour, size, and shape. It is cleaned and sifted by women with flat baskets, all white and unripe berries being picked out. The flavour of Harar Coffee is said to be bitter than that of Arabia. It is shipped largely to Aden for mixing with the pure Arabian berry, and sold as Mocha.

The husks and parchment are sold to the poor people who make a weak brew therefrom.

The following are the prices realized in Harar :—

Per farasula (37½ lbs.)

s. d. *s. d.*

Best selected beans 7 to 8 dollars (14/- to 16/-) = Rs. 10½.

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* Probably the brown bug of Indian coffee (*Lecanium hemisphericum*). *Ed.*

Sweepings	4	dollars	*s. d.* (8/-)	= Rs. 6.
Husks	2	,,	*s. d.* (4/-)	= Rs. 3.

The average yield is about two kilos (four and half pounds) dried beans per tree for native cultivators.

The leaves of the coffee plant are cut and dried in the shade, being then sold as tea. Broken up and boiled for a minute or so they produce an excellent drink much resembling a mild tea. It is much esteemed by natives, especially in the hot weather as a thirst-quencher.

The trees last thirty or forty years when they cease to yield a profitable crop.

Coffee cultivated by foreigners is planted wider about twelve feet apart and lightly pruned to a better shape. With good cultivation and manure the trees will yield as much as six kilos (13 pounds) of dried berries per tree. Where the soil is deep and good it is not necessary to irrigate, provided the surface is kept well broken up. Finally there is undoubtedly large scope for improvement in cultivation, and extension of this valuable crop especially in replacing the pernicious *Kat.*

Kat (*Catha edulis*) is another indigenous plant, which has spread to Arabia. Fortunately it has not spread its evil influence to other countries, but confines itself to the hills of Abyssinia and Arabia Felix.

It is a shrub not unlike a seed-bearing tea-bush, and like that product it is the tender shoots that are plucked. Unlike tea it is not subjected to periodical pruning or to further manufacture. It is propagated not by plants raised from seed but by shoots taken from older trees. There are several varieties of coarse and fine leaves which are more or less powerfully charged with a stimulating drug. The plants do not require irrigation and very little cultivation is given to them. The young leaf-shoots about six inches to a foot long, are plucked and sold. Most of it is consumed locally and a certain amount is sent to Dire Dauna and Djibouti in bundles. It is often cultivated in conjunction with coffee.

The leaves are chewed and the juice swallowed with a little water. Without its daily use the Galla lobourers are fit for nothing, and during *Ramadan*, when they are forced to forego it, they indulge in gross idleness and taciturnity. Its continued use in increased quantities leads to excessive stupidity and brain-feebleness. Its gradual eradication would do much to increase the status of the Gallas.

Gaishu :—This is a shrub cultivated for the connection of the Abyssinian national drink of *Tej*. This is made by mixing honey and water into which is stirred the bruised dried stalks and leaves of the shrub and left to ferment for a week. It forms a refreshing and nutritious drink and is not very potent. Ordinary Kaffir-beer is also made from fermented *Dourah*.

Fruits-Citrus :—Of these, oranges hold the highest place. The original plants have been imported from Italy, Egypt, and Syria. The trees appear remarkably healthy and at four years old bear heavy crops. They are well cultivated and irrigated during the dry weather. Older trees bear very fine crops of perfect fruit, sweet and thin-skinned Lemons, Limes, Mandarines, and Citrons also do very well. The fruits find a limited market in Djibouti, Aden and Adis Ababa, but insufficient to absorb all the crop, much of which is wasted.

Bananas :—These are grown in large quantities, but as little or no attention is given to their cultivation, the bunches produced are small in size and inferior in taste and quality.

Grapes :—Vines do well in sheltered valleys, and vine culture for raising might prove remunerative as the dry season would be ideal for drying them.

Apples and *peaches* grow but the fruits they produce are small and inferior and are scarcely worth cultivation.

Vegetables :—Almost all European vegetables grow exceedingly well, fine cabbages of very large size and beetroots up to three pounds in weight. Were transport easier and cheaper, there should be an opening for these for supplying the markets of the Red Sea ports during the hot weather.

Conclusion :—In conclusion I would state that I have retained my observations only for three months and entirely confine my remarks to the plateau on which Harar is situated. Unfortunately I have not been able to visit the richer portions of the Harar province such as the Chercher, Obora, Cumbalsha, and Feryimbiro districts where I believe vast resources exist. But it would appear to only require the stimulus of a more energetic government to produce fourfold the large variety of products to which undoubtedly many could be added. With such wealth stored in the soil of Harar awaiting guidance to bring it forth to its full value she would take her place in the civilized world and raise a primitive degraded race to a higher and improved status in life.

Reviews of some new books in the College Library

Agriculture.

A. 1350.—Tropical Agriculture by Wilcox (1916). One of the best, as a reference book of tropical crops and conditions.

A. 1352—56.—This is an interesting series on garden crops by Thomas.

A. 1360.—The story of Cotton by Brooks (1911). It is a plain and interesting history and trade of cotton in United States.

A. 1368.—Practical lessons in Tropical Agriculture by Clute. Very useful for those contemplating teaching in Agricultural schools like Loni Vernacular School.

A. 1378.—Creamery Butter making by Michels (1914). Good practical book on handling of cream and butter making.

A. 1379.—Milk and Milk products in the home by Michels (1915). Gives some hints on handling of milk.

A. 1392.—My poultry Day by day by Alfred Gibson. Gives the general principals on poultry keeping but no special adaptation for India.

Biology.

B. 924.—"Protoplasm and Microscopic Foams" by O. Bütschli. Authorised English translation by E. A. Minchin. 1894. Records the author's experiments and observations directed towards a solution of the question of the physical conditions of the phenomena of life. Various theories of the structure of Protoplasm are discussed.

B. 925.—"British Uradiness and Ustilagineae" by Charles B. Plowright 1889. A monograph on the British Rust and Smut Fungi. The first 118 pages might be consulted with advantage by special students of Mycology, as they give an excellent account of the biology of these groups of Fungi together with the methods of observing the germination of the spores and of their experimental culture.

B. 926.—Pansies violas, violets, B 927, Chrysanthemums, B 929, Carnations B 930 Apples and pears. These are four volumes out of a series entitled "Present Day Gardening" and edited by R. Hooper Pearson, Managing Editor of the Gardener's Chronicle. Each volume deals in detail with the cultivation, chief varieties (illustrated by beautiful colour photographs), diseases &c. of the subject. A good series for reference by Horticultural students.

B 931, B 932, B 933, B 934.—Cassell's Popular Gardening, 4 volumes. An encyclopaedia of gardening knowledge: useful for reference to students of horticulture; illustrated.

B 935.—"New and Rare beautiful leaved plants" by Shirley Hibbered; 1870. Useful to students of Horticulture; beautiful colour drawings.

B 936, B 937, B 938, B 939.—"Favourite flowers of garden and green house" 4 volumes 1896. A reference work; numerous illustrations.

B 940, B 941.—"The History of the Creation" by Ernst Hackel revised English translation by Prof. E. Ray Lankester 1816. A popular exposition of the doctrine of evolution in general and of that of Darwin, Goethe and Lamarck in particular.

B 942.—"California Garden Flowers" by E. J. Wickson; 1915; contains suggestions for working amateurs which, though intended for horticulturists working in California, may give ideas to Indian horticulurists.

B 943.—"Climate and Evolution" by W. D. Mathew; 1915, a publication of the New York Academy of science; is an elaborate essay on the origin and dispersal of vertebrate life and would interest students of biology who like to speculate on the why and wherefore of the dispersal of animal life as we find it to-day and the past history of present conditions.

B 944.—"Vegetable Teratology" by Maxwell T. Masters, 1869. An illustrated account of the principal deviations from the usual construction of plants; would interest mainly students of plant-morphology, but might be consulted by students of plant breeding.

B 928—"The flowers and gardens of Japan" by Ella and Florence Dulcane. Those interested in ornamental gardening would find the beautiful coloured illustrations very suggestive.

Chemistry.

C 910.—A chemical sign of life by Shiro Tashiro. Proves that every living substance gives out carbon dioxide and describes an apparatus to detect even extremely small quantities of carbon dioxide.

C 916.—Chemistry of farm practice by T. E. Keitt. Is a simple work on Agricultural Chemistry and may be read as an introduction to Agricultural Chemistry.

The G. D. Mehta Memorial Fund.

—:o:—

THE undersigned has great pleasure in acknowledging the receipt of the following subscriptions from the 11th October 1917 to the 16th January 1918.

	Rs.		Rs.
Mr. P. C. Patil	... 50	Mr. D. D. Abhyankar	... 5
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D. L. SAHASRABUDHE,

Hon. Secretary.

A REVIEW

OF

"All About the Mango"

" आम्रसंवर्धन "
अथवा
" आंब्यासंबंधी समग्र माहिती "

By V. K. Gadgil, B. Ag.

THE above is the title of a pretty little handy book written in Marathi (local vernacular) language by one of our enthusiastic graduates and introduced to the public by his preceptor Dr. Burns,—than whom there is no better authority on the ' Mango ' in the Bombay Presidency &c. who testifies as to its being " a laudable attempt to bring before the Marathi-speaking public the latest information on a most important and profitable crop " that " no pains have been spared to bring the book uptodate and to include in it not only Indian experience but also the experience of horticultural workers all over the world."

The author in his prefaratory note very rightly mentions that the responsibility of fulfilling the shortage of Marathi books on Agricultural topics rests principally upon the shoulders of our graduates and that in recognition of this onus, he had undertaken to publish a *Fruit Series*. This book is presented as the first of the series. The object of the series is to present in a concentrated form all specialised information that might be found both in India and Foreign literature on each fruit crop. We welcome this book as the first issue of the series and we congratulate the author on its production.

We have read the contents with great pleasure. It is written in an agreeable and clear style. The author has used some happy and felicitous words such as उघडीप, गर्दगुलाबी, पर्णकलिका, कुदलणा, &c. The selections from literature to which references are given in foot-notes are appropriately marshalled in a methodical sequence. Each of the important sub-heads of the subject have been treated with care and skill. Some of the most useful branches of the subject such as points to be remembered by a purchaser of grafts, method of preserving mango juice in sealed tins, description of points that go to make a good mango &c. &c. are described in an aptly and skilfully condensed, at the same time, explicit and accurate manner. Although it might indeed have been possible or certainly desirable to give some more information or add some discussion on some of the problems connected with mango culture—for instance the desirability or otherwise of giving salt as manure to mango trees in the Deccan still the writer seems to have taken care to err on the safe side by omitting any elaborate discussion or opinion on matters which need further experience. He has however entered upon some discussion as to the best Marathi words for '*Stock*' and '*Scion*'. After condemning one set of words with some plausible explanation and another without any, he has adopted a pair coined by himself. These are आधार तरु for *Stock* and स्थाप्यकतरु for *Scion*. These two vernacular words express only the relative position of the *Stock* and *Scion* on the graft rather than anything better. We are inclined to prefer the pair पोषक तरु for Stock and जातिवंत तरु for Scion since they convey the correct physiological relation between the two parts of a graft in addition to some more very appropriately pregnant meaning as regards *Scion*.

At the present period when paper, labour and printing is so costly we can very well see the anxiety of the writer to condense matter and therefore we have no quarrel with him for his pleading want of space for not treating in more detail some phases of the subject, but we do complain for his withholding such things as the proportions of the ingredients of insecticides the methods of the latter's preparation and for not taking cognisance of certain experimental results attained in the Ganeshkhind gardens while room is allotted for comparatively less important things.

Although we could find a bit here or there to complain of, we have no hesitation in stating that the book is a valuable addition to Marathi Agricultural literature. It is extremely useful to Marathi students of Agriculture and to others interested in the subject of the '*Mango*'.

(Sd.) G. B. PATWARDHAN,
Asstt. Prof. of Botany.

College News and Notes.

—:o:—

WHAT happy event of our College life, which recurs annually to the enjoyment of everybody concerned came to pass on the 7th and 8th of December and it is particularly saddening to note that everything did not occur within the limit of our desire. We are, of course, referring to our annual social gathering and sports. This year something exceptional occurred which was calculated among other things to try the mettle of our sportsmen. We are happy to make it public that under the circumstances they behaved gloriously well; they were required to resign their prizes and other enjoyable things for the purposes of the war fund, in connection with the celebrations for "Our Day" and then gird up all ungrudging. This year, as usual, old students and old members of the staff came together in large number to show that their love for this institution with which they were connected for a time is always growing strong and that nothing can snap the ties which keep them attached to us. This year, as in every year, staff and students met together with common feeling akin to comradeship and our feeling of respect for our superiors has become none the less for it.

The social gathering was in some ways a disappointment to us. We were expecting to have the presence of Mr. B. G. Horniman, the well-known publicist of Bombay to give the annual address to the college students. But at the last moment the provincial authorities thought it wise that, in the present political ferment, he should not attend their annual college function, and we acceded to the suggestion with profound regret. Our sincere thanks are due to Mr. Horniman for his kindness in promising to come when we asked him and also to Professor Limaye, of the Fergusson College who at short notice, was kind enough to come and deliver the address and hand the prizes to the fortunate recipients. His address was instructive and inspiring indeed, as he spoke in the attitude which Indian students should take towards the political events which are taking place in our times in India.

The "prize distribution," in the present case, meant merely the reading out, with the necessary accompaniment of cheering acclamation, of the names of the various lucky men who were deserving of prizes. A list of their names is given in another place, and we assure our readers that a happier hand of young patriots is not to be found all over India,—for they have, one and all, handed over the entire value of their prizes, without curtailment or deduction to the War funds.

The Student's Union, under its enthusiastic secretary Mr. Herlekar had arranged a trip to Sinhagad, the famous Maharatta fort during the earlier part of last X'mas. In spite of the many going home, a fairly large number rallied round the banner to ascend Sinhagad. There were about 30 of them. Still about 10 more would have joined but for the pre-arranged Foot-ball match with the Engineering College Team.

The cart party left Poona by midnight on 22nd December and reached the bottom of the fort in the early morning next day. The cyclists also arrived at the same time. Although it was a difficult ascent, the jolly fellows did not mind it as they had the exquisite scenery around them to relieve them of their fatigue.

A guide showed, and gave historical information about, the most important points as far as he could. Everybody was deeply moved to listen to some pathetic incidents.

A light refreshment was arranged on the fort. All were extremely pleased. They came down in the evening and the homeward march commenced.

We should like to call the attention of all readers of the Poona Agricultural College Magazine who are interested in Dairying to the existence of the Journal of Dairying and Dairy Farming in India published quarterly by the Indian Branch of the Dairy Education Association. This is undoubtedly the fullest and most authoritative publication on dairying in India, and will be found of great value by all those who have to deal with milking cattle or with the utilisation of milk. It costs Rs. 5 per annum and all information can be obtained from the Honorary Secretary, Dairy Education Association, 85 Survey Road, Quetta.

Oblituary.

We are very sorry to record the premature death of Mr. Hasan Alli who was a student in the First year of our College. He was a student from the Hyderabad State. He was suffering from a severe toothache but no body expected that the malady would take a serious turn and end in tragedy. He was one of the promising students of the class.

A meeting was held in honour of the deceased and a message of codolence from the College was sent to his relatives.

May his soul rest in peace!

Gymkhana Notes.

DURING the period under report some very important events took place in connection with our Gymkhana.

In the first place, the usual bye-law of holding the election of the Managing Committee in the beginning of the first term is changed. And from hence it has been resolved that the election of the members would take place at the end of the 2nd term. This has secured many advantages. The continuity of the work of the Gymkhana is maintained—which is perhaps of the paramount importance. There is the exchange of ideas between the old and the new Secretaries, and so on.

Secondly, the Tennis Tournament and the sports in connection with our College-gathering.

In the Tennis, we had a good number of students competing for the championship. There were two items. Open Singles and Open Doubles. In Singles Mr. Mir Syad Ali came out successful, while in Doubles Messrs. Herlekar and Gole carried the day.

In the Annual Sports, entries were completely satisfactory, not in any way less than usual. In the items of this year's sports, a digression was made from the usual groove. Instead of a running race, we had arranged a Slow Cycling Race for the members of the staff and the past students of the College. A Tug-of-War was arranged. In that the B. Ag. students beat all other classes and pulled the Staff also.

A complete list of prize-winners is given below. But we congratulate our friend Mr. G. N. Jog, of 1st year class for having won Lord Willingdon's Cup of all round Championship.

The play-ground for Foot-ball, Hockey and Cricket has been prepared near our Boat club quarters. Although it cannot be said to be an ideal one, still it is playable. Still some more money will have to be spent on it which we hope the next Managing Committee will do. The Tennis Court, is also complete and has become very fine.

There are very few other things to note. The Reading Room is attracting good number of readers. The Gymnasium is going on very smoothly. The Secretaries of the Debating Union should be congratulated on their splendid work. They showed the same enthusiasm as in the last term. A learned lecture on "Proportional Representation" by Hon. Mr. R. P. Paranjpye was arranged in this month.

List of the Prize-winners in the Annual Sports

OF

1917-1918.

1. Mr. Jog, G. N. ... All round championship (1).

2. Tennis Tournament :—
    Champion in open singles...Mr. Mir Syad Ali
    ,, ,, doubles..Messrs. Herlekar and Gole.
    Runners up ,, ,, ... ,, Hardikar Bros.

3. Wrestling ...1. Mr. Jog, G. N.
    ...2. ,, Gondhalekar, H. V.
    ...3. ,, Patel, L. K.

4. Jumping competitions ...1. Mr. Maung K. Zan, 1st in long jump and 3rd in high jump.
    ...2. ,, Jog, G. N., 1st in high jump and 2nd in long jump.
    ...3. ,, C. Raghunathan, 2nd in high jump and 2nd in long jump.
    ...4. ,, Abasi, A. U., 2nd in long jump.
    ...5. ,, Shinde, 3rd in long jump.
    ...6. ,, Kothawala, J. R., 3rd in high jump.

N. B.—Messrs. Jog, Raghunathan and Abasi jumped to the same length.

5. Chatty-Breaking Race : ...1. Mr. Kamat, M. N.
    ...2. ,, M. Ezekiel.
    ...3. ,, Patel, V. V.

6. Straight Plowing Competition.1. Mr. Kothawala, J. R.
    ...2. ,, Khatib.
    ...3. ,, Wagh, S. S.

7. **Putting the shot**	...1.	Mr. Patil, S. R.
	...2.	,, Maung K. Zan.
	...3.	,, Shinde.
8. **Short Running Races :**	...1.	,, Maung K. Zan, 1st in 100 yards and 3rd in 220 yards.
	...2.	,, Kothawala, J. R., 1st in 220 yards and 3rd in 440 yards.
	...3.	,, Jog, G. N., 1st in 440 yards and 2nd in 100 yards.
	...4.	,, C. Raghunathan, 2nd in 220 yards and 3rd in 100 yards.
	...5.	,, Nurhusenshah, 2nd in 440 yards.
	...6.	,, Abasi, A. U., 3rd in 100 yards.
9. **Slow Cycling Race :**	...1.	,, Marathe,
	...2.	,, Ranji.
	...3.	,, Daruwala.
10. **One mile race :**	...1.	,, Nurhusenshah.
	...2.	,, Kothawala, J. R.
	... 3.	,, Jog, G. N.
11. **Hurdle Race :**	...1.	,, Khe Maung.
	...1.	,, Abasi. He scored the same number of marks.
	...2.	,, Jog, G. N.
	...2.	,, Chougule. He scored the same number of marks.
12. **Three-legged Race :**	...1.	Messrs. Kothawala, J. R. and Abasi, A. U.
	...2.	,, San Tun and Patel Godrej.
	...3.	,, Maung K. Zan and Khe Maung.
13. **Obstacle Race :**	...1.	Mr. Abasi, A. U.
	...2.	,, Nurhusenshah.
	...3.	,, Bukhari.

14. **Sack Race** : ...1. Mr. Vijas.
...2. ,, Khe Maung.
...3. ,, Gondhalekar.

15. **Swimming Race** . ...1. ,, Khe Maung.
...2. ,, Kabraji.
...3. ,, Daruwala.

16. Throwing the Cricket Ball : ...1. ,, Kothawala.
...2. ,, Gondhalekar.
...3. ,, Bhatt, V. M.

17. **Slow Cycling Race for the members of the Staff**—
...1. Prof. Ramrao S. Kasargode of the department of Entomology.
...2. ,, Sahasrabudhe, D. L. of the department of Chemistry.
...3. Mr. Kanitkar, N. V., of the department of Chemistry.

18. Tug-of-War tournament : ...The Senior B. Ag. Students of 1917–18.

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THE
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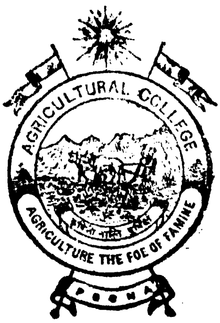
AGRICULTURAL COLLEGE
AGRICULTURE THE FOE OF FAMINE
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The Managing Committee of the College Gymkhana, 1917-18.

STANDING :—Messrs. Ragunathan, Kamat M. N., Maung K. Zan, Gole.
CHAIRS :—Messrs. Vyas, Herlekar K. V., (General Secretary) Prof. Godbole S. S., (Chairman) Mr. D. B. Bhonsle, (Magazine Manager). Mr. C. M. Bhatt.

THE POONA
Agricultural College Magazine.

Vol. IX.] MARCH 1918. [No. 4.

EDITORIAL.

THE PRESENT AGRICULTURAL SITUATION.

AT the commencement of the present world war we ventured in an editorial article in this magazine, to try and describe the immediate and probable future effects of the great international struggle on the agricultural situation, on the crops which it was desirable that farmers should produce, and on the position which a cultivator should and would hold in the community. Now, as we write, the war has lasted far longer than the most pessimistic forecasted at that time, it embraces a much larger number of countries and directly affects a much larger area than was the case then and considerations enter into the matter which no-one thought of in the autumn of 1914.

The most important of these considerations is the immense reduction in the produce of the countries directly affected by the war. In France, it is stated that the production of food grains was in 1917, one third less than the normal, in Germany, Austria and Russia the crops were far below the normal, and the same, though in a similar measure, applies to other countries. This is due to the enormous withdrawal of trained agriculturists from the land to the armies of the various nations, and to the lack of expenditure on manures and other necessities for full crops. When one considers that these are mobilised, in the armies in Europe and elsewhere, at least thirty millions of men, the greater part of whom are withdrawn from production in some form, and many of them from farming and cultivation, it is hardly a thing to be astonished at that the agricultural production falls and falls to a very considerable extent.

But not only is production necessarily smaller, but consumption is not decreased, if decreased at all, by anything like a corresponding amount. Prices have risen, for reasons into which we cannot enter here, and this has restricted consumption among the civil population, but the armies are enormous consumers on practically the old scale, and army consumption is notoriously wasteful consumption.

The result of this very much diminished production and at the same time undiminished or only slightly diminished consumption is a very alarming situation, and the world appears to be faced with famine conditions on an almost unheard of scale. At present this is evidenced by a general rise of prices to what are practically famine figures. And the whole situation throws a responsibility on the cultivators of the soil, in all countries unaffected or only slightly affected by the war, to increase production chiefly of food but, in a less measure, of all the necessities of life, to the greatest extent possible.

Such is the position as it appears at present to us. The crops in India in 1918 ought to be, so far as the varying conditions of climate will allow, unprecedentedly high. We have always maintained that higher cultivation, better manuring, greater care in planting, more careful selection of seed and of crops would all pay and pay well even under normal conditions. Now all these things become a national, or even an international duty,—and appear, in spite of the rise in the price of labour and other necessities, very much more profitable than before. But higher cultivation means the use of the best and most effective implements known. Better manuring means very often, at least on irrigated land, the use of artificial manures, under which term we include oilcakes and fish, and these have risen in price here less than almost anywhere. The selection of seed and of crop demands a greater knowledge of outside conditions than most cultivators possess. But they can be done, and no energy should be spared either by ourselves or among those whom we can influence, to rise to a public duty in what is almost certain to be a great world crisis, in regard to the supply of the necessaries of life.

Experiments on Grape Vines.

BY

G. B. Patwardhan, B. Sc.,

Assistant Professor of Botany, Poona Agricultural College.

DURING the course of the last ten years the writer has interested himself in the cultivation of grape vines in the Ganeshkind Botanical Gardens, Kirkee, and also in other parts of the Bombay Presidency. Experiments on various aspects of culture, variety trials, treatment of diseases, use of proper tools &c., were carried out both here and in the mofussil, principally at Nasik which is the chief grape growing centre in the Presidency. The most serious disease prevalent, the powdery mildew (*Oidium Tuckerii*), which has been responsible for the annihilation of many vineyards at Nasik and Ahmednagar and which had made grape culture an extremely speculative concern, naturally received first attention and measures were taken to combat it. Other problems were also taken up and efforts made to deal with them. Propagandist work in connection with successful problems has also been carried out in the cultivators' own fields in Nasik, Mundwa, Satara, and Junnar, and their belief in the method recommended has been thus secured.

In order to take a review of all the work done so far and also to offer, in brief, the details of the results for the information of the members of the Board of Agriculture which met here in December last, the following statement was prepared. It is now presented for the information of a wider public.

The following results have been obtained :—

1. It has been proved that grape vines can be successfully and profitably cultivated under Poona conditions.

2. An improvement of grape vine beds has been made. The Nasik cultivator's method is to have at the foot of each vine a trough twelve inches deep. This trough is filled with water at each irrigation. We now make rings some distance from the plant and give water more or less at surface level.

3. We economise water and thus reduce moisture in the atmosphere of the vineyard and thus indirectly help in the reduction of chance of mildew spreading.

4. The quantity of water required by grape vine plants in the fruiting season i. e. from October to April has been measured. The total required is about 300,000 gallons per acre under our conditions of planting.

5. It has been found that the large cuttings or stumps of *Pangara* (*Erythrina indica*) if planted at the outset along with young vines retard the growth of the latter. The young vines refuse to shoot upwards but remain stunted while the cuttings of *pangara* strike root and grow. Therefore it is a great advantage to drive in the ground near a vine, soon after planting the latter, slender stakes of wood for the vines to catch hold of to be replaced later with thick stumps.

6. The "*Bucko*" hand cultivator has been used for stirring the beds with great success.

Training.

7. Training on the single stake system is more economical than training overhead or on the four stake system in places where field conditions of culture prevail.

8. Training on the umbrella system has given an yield of 40 lbs. of grapes per tree while one vine trained on a single stake has given a minimum of 19 lbs. of grapes per tree–both trees of the same age.

9. It has been demonstrated in Poona that one grape vine nine years old trained on the extensive system on an overhead bower covering an area of about 350 sq. ft. has yielded 800 bunches of a total weight of about 250 lbs.

Diseases.

10. Powdery mildew (*Oidium*) can be successfully combated by four to five sprayings, in the year, with Bordeaux mixture. Three of these sprayings should be with normal mixture, and two sprayings with half strength. Soft soap is used as an adhesive.

11. The spraying of one acre of vines costs Rs. 22-8 and it saves Rs. 200 to Rs. 250 per acre which would otherwise be lost owing to the disease.

12. If the last spraying with Bordeaux mixture of half strength is done in good time before the actual harvesting of the bunches, no stains or only a few faint ones–are left on the berries. The Nasik cultivators have felt no difficulty in marketing their crop. Similarly we have not been confronted with any in the Ganeshkhind Gardens.

If any stains are found objectionable they are easily removed by just dipping the bunches and stirring them in water.

13. There is no danger from poisoning. The worst stained bunches contained an average of .007 grammes of copper in a bunch weighing 153·2 grammes. This means that in order to absorb 0·5 grammes of copper which is the maximum amount that may with safety be absorbed daily (*vide* "Spraying of Plants" by Lodeman Page 232) the consumer could eat with impunity twenty five pounds of grapes. Thus the excess of grapes would begin to trouble him earlier than any possible indications of copper poisoning. The most economically and carefully sprayed bunches of grapes (*vide* Ganeshkind Garden Annual Report 1914–15) " contained 0·0014 per cent of copper or a minute trace." Considering this quantity as a basis one must eat 75 lbs. of grapes before even the slightest symptoms of copper poisoning becomes perceptible.

14. The possibility of any staining of the berries is removed by spraying once or twice with the mixture known as *Ammonium copper carbonate* mixture. This mixture has been found efficacious both in the Ganeshkhind Gardens and at Nasik and is offered to such cultivators as would take the trouble of preparing and spraying two mixtures in the season. The cost of the Ammonium copper carbonate mixture is not more than that as the Bordeaux.

Propagandist Work.

15. The remedy against mildew has been very successfully demonstrated in tracts (Nasik) where grapes are cultivated by agriculturists. The demonstrations have been so effective that practically all the cultivators in Nasik have taken up the spraying and do it at their own cost as one of the regular routine operations in connection with grape vine cultivation.

16. Sprayers were unknown in the grape growing tracts in 1909. Now almost every cultivator has provided himself with one "-prize-bucket sprayer " costing Rs. 16 and a few have bought *knapsack* sprayers and *Autosprayers* costing Rs. 60 and Rs. 75 respectively.

17. Secateurs were previously unknown. A sharp sickle called *Narket* was used for pruning grape vines before 1909. Now almost 50 % of the pruners use secateurs.

18. Some of the agriculturists prune their vine yards themselves without engaging professional pruners. The use of the *Narket*

requires greater skill than that of secateurs. Thus there is a saving to the agriculturists of the fees of the pruner which are about Rs. 4 per acre.

19. Recent inquiry made at Nasik shows that the agriculturists are buying the ingredients of Bordeaux mixture even though the prices have advanced by 150 per cent.

20. A spraying outfit (dress) has been devised and used.

An Improved type of Cotton for the Southern Maratha Country.

BY

G. L. Kottur, B. Ag.

COTTON is the most important crop in the black soil tract of the Southern Maratha Country. The area in the Bombay Karnatak comprising the three districts of Belgaum, Bijapur, and Dharwar, is about one million acres. The adjoining native states of Kolhapur, Miraj, Sangli, Hyderabad and Mysore also grow cotton on considerable areas. Some parts of Madras which are important for growing cotton resemble the Bombay Karnatak and therefore come under our scope. We have thus a very extensive cotton growing tract in the Southern Maratha Country which on account of its similarity admits of one solution.

The cotton cultivated throughout the length and breadth of this tract is a variety or *Gossypium herbaceum* (Gamie) known as *Jowari-hatti*. It is botanically identical with "Broach" but differs agriculturally in many points. It can be described as a *rabi* or late sown cotton producing seedy *kapas*, one fourth only of which is lint. The latter reaches the spinners under the name of *Kumpta* and is generally of good quality. It is suited to spin "thirties" and as such, ranks high in the list of long staple Indian *Deshi* cottons.

We have in India few long staple cottons and even these are in danger of being driven away by the short staple forms. The conditions in the Southern Maratha Country are however unfavourable for the growth of the short staple varieties, which are gaining ground in other parts of the country. Being encouraged by this fact, attempts were made to introduce the superior long staple variety of Gujarat viz. 'Broach'. The latter did give some promise of success in the beginning. But the present experience goes to indicate that Broach cannot replace the local cotton to an appreciable extent, even in the district of Dharwar for which it is supposed to be most suited.

Other varieties have also been tried with the same results. Cross-fertilisation was then adopted as a means of evolving better types. The story of cross-fertilisation in these tracts is rather a long one, but from the results obtained so far almost all crosses made have been disappointments.

Jowari hatti is an early ripening variety. It is sown in the month of August and September and is ready for the first picking in February and March. It grows rather short and gives a poor yield. The ginning percentage is also low. Thus the total quantity of cotton produced in the tract is comparatively small when compared with the large area cultivated. The average outturn of *kapas* is 320 lbs. per acre equal to 80 lbs. only of clean cotton. The staple though long is irregular, uneven and often weak. These drawbacks tend to unsettle what is otherwise the most profitable crop in the country.

All cottons derived from *Gossypium herbaceum* produce a number of extra-axillary vegetative branches of limbs from the lower portion of the central stalk. The limbs grow and branch like the main stalk. At each node above the limbs, the main stalk bears two kinds of branches (1) extra-axillary or fruiting and (2) axillary or vegetative. The former grows zigzag at nearly right-angles from the central stalk and produces at each node a pedicel with the solitary flower. The axillary branches behave like limbs and branch again before they bear any reproductive organ.

The first flowers are always borne on the fruiting branches of the main stalk. The limbs produce these at a later stage, while, the axillaries are the last in this respect. Thus a variety producing only the fruiting branches from its main stalk would be early while another producing a large number of limbs and axillaries would be late. This difference however is immaterial if the environment is favourable for the reproductive activity of the plant, throughout its growing period. But such a favourable condition is never obtained especially in the life history of any dry crop in the Southern Maratha Country. The cotton plant almost invariably receives a check in the month of February or March. This makes it necessary for us to restrict ourselves in the matter of selection to these forms which do not extend their flowering beyond this critical period.

As regards the form of branching, the local variety can be subdivided into two types (1) Erect (2) Bushy. The erect type is characterised by the meagre development of limbs and axillaries. It grows tall and produces from each node a prominent fruiting branch. The bushy type has a number of limbs varying from five to ten. Its fruiting branches on the main stalk are insignificant being smothered by the axillaries more or less vigorously growing by their side. Following this difference in branching the one is early and productive, while the other is late and unproductive.

The two types are found mixed in all cotton fields of the Karnatak. From a number of observations in 1912 it was discovered that the erect type was more prolific than the bushy.

This was further confirmed by actual field tests, after which one best plant of the type was obtained by means of unit selection. This has given us a new variety which is a distinct improvement. It is continuously giving better results in the trial plots on the Dharwar farm and gaining popularity with the *rayats* in the Karnatak. A great demand has already been created for seed and efforts are made to multiply it as fast as we can.

The improved type grows taller than the ordinary *jowari hatti.* Having few limbs or axillaries it suffers less from overcrowding in the rows ; the superiority however is more appreciable in its economic characters. It yields twelve percent more *kapas* and twelve percent more lint than the local *jowari hatti.* The staple also shares the improvement. It is being valued five percent more than the best *Kumpta* cotton available in the market. The following report of Messrs Forbes, Campbell & Co., of the Gokak Mills, who kindly made a spinning test of our cotton, testifies to its importance in the spinning industry of the future.

"The cotton was considerably superior to any of the *Kumpta* cottons as supplied by the *rayats* or which we have obtained from the near markets. It is bright, light, clean, long in staple and uniform and of middling strength. From it we spun three counts viz. 20s, 30s, 40s. The yarn ran smoothly and demanded very little attention from the work people and we would no doubt have received better results had we had sufficient cotton to make it worth our while to alter our machinery, so that it would be spun into yarn under the best conditions."

In conclusion, the new type evolved on the Government Farm Dharwar is calculated to improve the economic condition of the cotton growers in the Southern Maratha tract and give the latter special importance among the great staple-cotton tracts of India.

Cheddar Cheese making at Ahmedabad.

BY

B. S. Patel, B. Ag.

CARE OF MILK :—The milk required for cheese making must be fairly fresh and free from abnormal odours and as clean as possible that is to say, it must be free from dung, grass, dust etc. This can be secured if reasonable care is taken in collecting milk delivering it into the factory within couple of hours after milking into fairly clean utensils. Milk from freshly calved animals must be rejected at least for ten days.

In the creamery at Ahmedabad the milk is delivered in head loads in two to four hours after milking by ordinary milk dealers. No special care has been taken except in summer when some efforts are necessary to get in milk as early as possible to avoid troubles with undesirable ferments. Often we have had to pasteurise milk and especially so in the latter part of the summer and in the monsoon, to control flavours and acidity. But these troubles may be avoided by establishing a factory in a locality where sufficient milk can be brought in within two hours after milking.

Treatment of milk in the Factory :—The milk as it comes in the dairy should be strained through double layers of muslin and preferably through a " Ulax " strainer using cotton filters. The milk then may be weighed and should be treated for fat percentage as well as for specific gravity to secure pure milk. Whole milk and separated milk may be then taken in proper proportion to give milk containing about four percent of fat. If there is any troubles with abnormal flavour either part or even the whole of the milk should be pasteurised. Part pasteurisation has given no cheese of better flavour than when the whole was pasteurised but even the pasteurised milk alone gives us quite good cheese in course of time. Any milk with acidity over 0·2% is likely to give trouble if the rest of the milk is not much fresher.

Ripening of Milk :—Ripening means the formation of a certain amount of lactic acid in milk before rennetting. This is usually done by the use of a commercial starter. The use of a starter is necessary to control more completely the various operations in cheese making. The starter must be added to the first lot of milk received in the dairy as soon as possible to control abnormal fermentation.

Starters :—Starters are of two kinds:—(1) Natural and (2) Commercial starters.

Natural starters are prepared by allowing lactic organisms present in some clean milk to grow at 90° F. to 95° F. But these are not always reliable.

Commercial starters are pure cultures of certain lactic organisms in the market such as " Hansen's Danish Lactic Ferment " and " Barnekow's (Swedish) Lactic Acid Ferment." These cultures are specially prepared in laboratories by trained bacteriologists and are used for cheese and butter making. These cultures sour milk and produce a firm curd free from gas bubbles and with only a little whey on the surface. Such a curd should have pleasant clean acid taste entirely free from taints.

Starter making :--To make a starter the following process should be adopted. Pasteurise ten pounds of clean whole milk or preferably separated milk to 190° F. let it stand for an hour, and heat it again to 185 to 190° F. and cool it immediately to 90° F. and add the small bottle of the culture. Stir it well every fifteen minutes for the first three hours and leave it covered for 18 to 24 hours during which it would coagulate,

Next day if the curd is firm and free from gas bubbles about 1½ lbs., after removing the top part, should be used to inoculate another ten lbs. of milk pasteurised and cooled to 70° F.

A further inoculation may be carried on a third day with one pound of starter and then the starter will be ready for use if the curd is firm, free from gas and taints and which has pleasant clean acid taste.

The propagation of the starter must be carried on from day to day using about 3 to 6 ozs. of it in fifteen pounds of milk. Every thing that comes in contact with the starter must be thoroughly cleaned and sterilised.

From 0·5 to 1·5 percent of starter is found sufficient to ripen milk in 1½ to 2½ hours. The starter should be strained through a fine cloth. If coloured cheese is made the starter should be added before the colour, otherwise white spots may be produced in the curd.

The amount of starter varies with the degree of acidity of the milk when received in the dairy and the acidity and strength of the starter as well as the season and treatment of milk. Pasteurised milk and winter season milk need more starter.

The general aim of ripening should be to have such a degree of acidity when the rennet is added that the curd will remain in whey not more than three to three and a quarter hours. This time varies with the season. The important point is that the curd must be properly firm before too much acidity has developed.

Usually when the acid test shows between 0·19 to 0·21 percent of lactic acid the proper degree of ripeness has been reached.

Adding color :—Color should be added before rennetting and be thoroughly mixed with the bulk of the milk. The color used here is of Swedish make and one ounce to four hundred pounds of milk has been found sufficient.

Rennetting :—Rennet is added when the milk is ripe. The milk should be best rennetted at 86° F. Enough rennet should be added to coagulate milk fit for cutting in 35 to 45 minutes. From my experience it would seem that buffalo's milk requires a little more rennet than cow's milk. About three to seven ounces of rennet per 1000 lbs. of milk (depending upon the strength) has been found sufficient.

The milk should be thoroughly stirred before the rennet is added. The rennet should be diluted with five to ten times its quantity of cold water and added over the whole length of the vat and the milk should be well stirred for three to five minutes.

Rennet substitutes such as " soluble pepsin " and " subrenna " have been successfully used in making cheese.

Cutting the curd :—Curd must be cut at the right stage of firmness. The curd is ready to cut if the curd breaks apart with a clean fracture without leaving small bits of curd on the finger when the end of the index finger is inserted obliquely into the curd an inch or so and then slowly raised to the surface.

If the curd is cut too soon the loss of fat and probably of casein is increased and there is a smaller yield of cheese. If the curd becomes too firm it cannot be cut uniformly.

Two sets of steel knives with sharp edges are used in cutting. The curd should be first cut slowly lengthwise and then crosswise with the vertical knife and then the horizontal knife should be used in the same manner. If necessary the second knife should be used a second time. The object of cutting the curd is to allow the whey to escape from it.

Effect of cutting coarse or fine :—The effect of cutting the curd fine is to release the whey more rapidly and completely and thus to get a cheese with less moisture. This fact is made use of in handling over ripe milk as the quick escape of whey enables one to control better acidity in the curd.

Stirring curd after cutting :—The curd should be stirred gently with the mand and for about ten to fifteen minutes after cutting until the pieces of curd become firm enough to stand stirring with a wooden rake. Stirring is necessary to prevent massing up of the pieces. The curd should be kept stirred till the pieces become properly formed.

Heating the curd:—The normal acidity at heating is 0·13 or 0·14 % in the free whey. The rapidity with which the lactic acid develops regulates the start and speed of heating. Normally in the first 20 or 25 minutes temperature is raised to 90° F. i. e. at the rate of about 1° F. every five minutes. Then the temperature is raised to 98 to 102° F. in the next 20 or 25 minutes. The heat should not be applied too quickly at the start otherwise we get too tough and leathery a curd.

The temperature of heating varies from 98 to 102°F. It depends on the richness of milk in fat. The temperature of 98° F. for milk containing 3·7 per cent fat is as good as 100° F. for milk containing 4% fat. The temperature may have to be raised even higher than 102° F. in case of over ripe milk. The lower the temperature used for heating the curd, provided the curd be properly firmed the smoother will be the body of the cheese. The stirring should go on even after the temperature is reached for 20 to 40 minutes to get the curd properly firm.

Removing Whey from the Curd :—The following indications show when the whey should be removed from the curd.

1. When a lump of curd from which whey is properly pressed out, shows, on rubbing on a clean dark hot iron, fine threads one eighth of an inch in length. We do not get here as long and fine draw as one gets in Scotland at this stage.

2. When the last portion of whey pressed out of a mass of curd shows about 0·44 to 0·49 % acidity. This acidity is much higher than I found in Scotland at this stage viz. 0·27 to 0·30 %.

3. When the pieces of curd are firm and springy enough to the feel.

Stirring Curd to dry it.—When most of the whey is removed from the curd, the latter should be lifted on to cooler which is laid with a draining rack and covered with a coarse cloth. The curd should be stirred enough to keep a proper amount of moisture (whey) in it. Too much free whey left in the curd at this stage enables lactic acid to develop too fast which should be avoided. Over stirring will leave the curd too dry.

Cheddaring the Curd :—Piling and matting.—The curd should be piled six to eight inches deep or evenly after it is sufficiently dry, and covered with dry cloths. When the curd has matted together sufficiently forming a solid mass which happens in about 15 to 25 minutes it should be cut into strips eight or nine inches wide and these turned over the top going on the bottom. Moist curd may be cut into narrower strips and turned as soon as matted. After another twenty five minutes these are turned over again and piled in layers two deep. After the same interval they are turned over again and piled in layers four deep. The same turning at similar intervals should go on till ready for milling. If the curd is very moist and quick in developing acid the strips should not be piled in deep layers. The turning is done to keep the temperature uniform through the mass. The objects of cheddaring are (1) to remove whey (2) to produce a characteristic change in the body and texture of the curd.

The physical condition of the curd changes from a tough and rubberlike consistency with high water content into a mass having a smooth and velvetty feel and somewhat plastic consistency. The texture also changes so that the mass tears off into peculiar leafy fibres. Also the curd forms longer and finer strings on a hot iron usually half an inch or more after the cheddaring has continued for some time.

The chemical analysis also shows that the proteins appear to undergo chemical changes and the drawing of strings is attributed by Van Slyke and Publow to the formation of a substance which is soluble in warm five percent brine.

The cheddaring process is considered as complete when the curd forms strings on a hot iron three quarters of an inch to an inch long and smells like roasted cheese, and when it has characteristic melow feel.

Milling.—When the cheddaring process is complete as determined by the tests given, the curd is ready to mill. The curd should be weighed before or after milling. The objects of milling are to cut the curd into small pieces of uniform size so that salting may be done more evenly and the curd may be handled more conveniently during the rest of the processes, and also to get rid of more whey. The mill should cut the curd into pieces of uniform size and should not crush or squeeze the fat from the curd.

Stirring and aerating curd.—After milling the pieces of curd should be well stirred, kept apart and freely aerated. At this stage the freshly cut surfaces afford an excellent outlet for the escape of gases and undesirable flavours. In Scotland the curd is piled up again for half to three quarters of an hour or more before salting to complete the process of cheddaring but here it is preferable under normal conditions to allow the full cheddaring before milling and to salt the curd as soon as the curd is cooled to about 85°F.

Salting.—Salt is applied at the rate of two percent of the curd. Moist curd is usually salted slightly higher. Salting checks the development of lactic acid so care should be taken that the curd has matured enough before salting. Fairly coarse salt is preferable to ordinary butter salt. The salt must be clean and free from lumps before it is used.

The curd should be spread evenly and sprinkled with about half the amount of salt and then stirred well to mix the salt. The curd should then be spread again and sprinkled with the rest of the salt as before and again well stirred. The curd should stand for fifteen minutes in salt and stirred up again before hooping. The objects of salting are as follows :—(1) It helps to remove more whey (2) It checks or retards the formation of acid (3) It retards undesirable forms of fermentation (4) It imparts flavour. Unsalted cheese cures more quickly and is apt to develop a bitter flavour and especially so when cured at higher temperatures. Excessive salting on the other hand makes the cheese mealy and too dry while it cures slowly.

An incured amount of salt is added to correct a fault such as gassiners, very high acidity or softness in cheese.

Hooping the curd.—The hoop or chesset should be prepared by wetting it with warm water and lining it with a wet cloth. Then it should be filled up with curd. The curd must be cooled to 80 to 85°F. in summer by the use of chilled water or ice water before the chessets are filled up. Cheeses should be as nearly uniform in weight as possible.

Pressing curd and dressing cheese.—A screw type gang press is in use in the creamery at Ahmedabad. The pressure is applied lightly and gradually at first. The screw is tightened as soon as it gets loose. The chessets are once more taken out and the cloths are drawn up and cheeses are put back in the press and the screw is tightened up. The acidity of whey running from the press should be taken. The acidity at this stage should be 1·15 to 1·2 percent. After about two hours, full pressure is applied by proper tightening up of the screw. The pressure should preferably be constant, which can be done only by a weight and lever arrangement.

Next morning the cheeses are taken out of the chessets and are dipped for a minute into hot water at 135 to 140°F. and are put back into the chesset for a couple of hours without any pressure. Then the dry smooth cloths are put on and dry chessets are used and the cheeses are pressed again.

Next morning the cheeses are taken out for dressing. The tops and bottoms are greased or starched and round cloth tops and bottoms are stuck on. Also the sides are greased and the bandage is tied round and sowed at the end. Again the cheeses are put back into the chesset and pressed again a full pressure being applied. The cheeses are taken out either in the evening or next morning and dated, numbered, weighed and taken into the curing room.

Fine finish is of the utmost importance and there is no excuse for not getting it. There should be no colour on the top.

Case of Cheese in curing room.—The cheeses are kept on the wooden shelves which must be properly scrubbed and dried before use. The cheeses must be turned once a day to avoid misshaping at least for eight weeks.

Watch must be kept for mites and moulds. If mites appear at all the cheeses must be well brushed and the store must be properly cleaned. Moulds can be kept back by keeping the air in the curing room fairly fresh and not too moist. Wiping the cheese with a dry cloth every day while turning will check moulds.

Properly made curd should not loose more than 10 per cent. in pressing.

Losses in curing depend upon several conditions, the chief of which are the following:—(1) The temperature of the room (2) Humidity of air in the room (3) Protection of the surface of the cheese (4) the size and shape of the cheese (5) the percentage of moisture originally present in the cheese (6) the texture of the cheese (7) the age of the cheese.

The higher the temperature the greater the loss. The cheeses are cured in Scotland at 62°F. and here we have been curing at 65 to 70°F. A temperature between 70°F. to 78°F causes fat to melt slightly but if the temperature rises above 80°F. the melting of fat is much greater and also the loss of moisture is increased. The greater the saturation of water vapour in the air the less the loss, but we get more troubles with moulds.

Paraffining cheese reduced the loss of moisture considerably but it did not give a hard rind if done too early to prevent losses. Also it gave troubles with mites. It takes 3 to 6 months to properly cure the cheese, the losses in first three months being by far the greatest.

The losses in curing will vary from 3 to 7% in three months at 65°F. and fairly moist air in the store.

The cheeses cured at lower temperatures are slow in curing but the abnormal flavours are checked. I have had to destroy some cheese made on the same day but kept at higher temperatures for curing as they developed bad fermentations.

Yield of cheese :—We have got so far about 9 lbs. of ripe cheese per 100 lbs. of milk containing 4% fat.

Possibilities of cheese industry';—The above description gives some idea of cheese making in Gujarat and I am glad that the cheese produced at Ahmedabad has been well spoken of by the people who use them. So it would not be out of place to give some idea of the immense possibilities of this industry in Gujarat.

Gujarat and espesially northern Gujarat is one of the greatest dairying districts in India and the district is covered over with separators in every village but unfortunately no use is made of separated milk by preserving it for human food.

The villages producing from 1000 to 4000 lbs of milk are numerous and are well located round suitable centres in groups of ten or more within a radius of two to three miles. Such centres are found in Nar, Dabhow, Palana Anand, Napad, Bhalaj, Umreth, Nadiad, Chaklasi, Boriavi, etc. Each of these places is capable of being a good centre for a central cheese factory.

The central factory ought to be equipped with big storages and curing room for cheeses produced in the surrounding villages, each of which producing from 1000 to 4000 lbs. of milk at every milking or likely to get the quantity delivered within two to three hours, can have a small cheese making plant. The plant would not cost more than Rs. 2000 to 5000. There is a splendid opportunity of organising each village on Co-operative principles to undertake cheese making. The cheese made by the village factory may be sold to the central factory as well as the surplus cream. By so doing the people can control sale of milk and milk produce and can get a good price for their milk and can as well reserve enough milk and ghee for their own use without a lose of a pie. Here is an opportunity for the people who are not in favour of the present system of dairying.

The central factories may be taken up by the unions of such village co-operative factories at a later stage and thus the whole industry can be organised for the benefit of the farmer.

Cheese making may be preferably practised only in winter in which case there can be less number of branch factories or even the central factory alone would suffice. But in that case there cannot be any scope for co-operative village factories neither we can make farmers interested in the central factory to improve the quality and cleanliness of milk to produce first class cheese. First class cheese can be produced only if the factory is on the spot where milk is produced.

The difficulties in taking up the cheese industry on a large scale are many—firstly we have not got trained cheese makers, secondly, the co-operative movement is too slow, thirdly there are no central factories. But none of these difficulties are unsurmountable if we first begin with a central factory where cheese makers may be trained up under an expert for a year or so to take up work in the village. The central staff can also give from time to time necessary expert advice to the cheese makers for some time.

The requirement of cheese in India itself is so great at present and the prices are so good that there is money to be made in the business which can be started with a capital of only about Rs. 50000.

Moreover the demand for food and especially in such a concentrated form for easy transport is very great for Great Britain and Mesopotamia and it is a great pity that this branch of the dairy industry is not developed even for the sake of helping in the war if not for helping the farmer.

At present the most valuable material viz. casein of milk is going to waste as it cannot be used as food and is fetching a much lower price compared with the value of cheese, which can be turned out from the milk used for casein manufacture.

Packing of Grapes in Ahmednagar for Export to Out-Stations.

BY

G. B. Patwardhan, B. Sc.

A very curious or rather a unique method of packing is adopted by the Ahmednagar *Bagwans* who export grapes from that town. Bunches are brought from the moffasil villages in flat shallow baskets which are about two feet in diameter. The bunches in these baskets are covered by a thick layer of grape-vine leaves. On arrival at Ahmednagar the grape bunches are transferred from the baskets to earthen jars each holding about 15 seers (10 lbs.) The leaves are used over again for stuffing between the bunches. The accompanying illustration shows the form of the jar used as also other details which follow. Each jar is supported at its bottom on a ring made of wicker work. The wicker is sometimes replaced by a coil made of dried banana leaves, folded or twisted round and round and further strengthened by twisted coir string. The mouth of the jar is first closed by a flat plate of tin and covered over by gunny sacking which is fixed round the neck of the jar by tying fast with coir. The jar is further armoured by strips of the coir string passing round the vessel and across from top to bottom. The cost of packing one jar including its price and delivery to railway station is 12 annas. The contents of the jar (grapes) cost to the *Bagvan* locally Rs. 3-8 or Rs. 4. Thus packed, the jars travel safely to Bijapur, Wadi, Hyderabad (Deccan), Bhusaval, Bagalkot, Sholapur, and Hubli, etc.

In the Deccan fruits of all kinds are practically always exported in packages which are made of bamboo baskets. It is curious that a delicate fruit like the grape is packed in closed earthen jars like this in Ahmednagar town only. At Nasik, which is the principal grape-growing tract of this Presidency and from which place numerous consignments are exported every day during February and March in each year to distant places in upper India, the packages are made of only ordinary bamboo baskets. At Satara also the same kind of pacakge is used.

The method of packing explains the psychology of railway transport of fruit in India. Fruit packages do not receive, at the hands of railway and motor transport companies that measure of attention which is necessary for delicate transport. They are often dashed on the ground or thrown topsy-turvy in vans They usually receive very rough treatment at each shifting consequent on loading and unloading, the more so when the packages are transhipped at junction stations where they are indeed very roughly handled, with little consideration as to the nature of their contents. Some times they are much bruised, torn or shattered. Last summer I had an occasion to witness how small baskets containing strawberries were thrown up like balls into motor lorries at Mahableshwar. I might add here that the method of packing in vogue at present does leave much to be desired. Still the transport agencies cannot be completely condoned.

In the instance under notice I think the earthen jar is preferred by virtue of its brittleness alone. The Railway porters knowing the fragile nature of the receptacles unconsciously take care to lift it well and replace it lightly on its protected bottom. Thus there is little fear of its being thrown about topsy-turvy. An ordinary basket package does not excite that natural commiseration, if I may use the word, which a brittle object does in the minds of those who handle them, and thus phenomenal security against neglectful breakage is obtained. Grapes from Nasik are exported to distant places such as Delhi, Lahore, Lucknow, Calcutta etc. There the exporters have the advantage over their brethren of Ahmednagar in the frequent train services on that line. The fruit consignments are booked by direct route to all the important stations in India where the commodity is in much demand, so the danger of rough handling consequent on transhipment at junctions is easily avoided and their packages are secured. These advantages are denied to the Ahmednagar dealers on account of the position of the city on the lines of communication. The packages from Ahmednagar must cross one junction at least before reaching any good market. To reach some destinations like Hubli they must pass over three junctions which are danger points for packages. At any rate these cheap receptacles have stood the test and are found successful by experience.

I might add that the consignment received by me was packed 24 hours before arrival here. The contents were good but the inside of the vessel was not cool. Further observations on the keeping quality of grapes so packed are needed.

It may interest some to know that eggs are transported to Bombay from the mofussil over the B. B. & C. I. Railway in similarly packed earthen jars.

The earthern-jar-packing of grapes.

An Economic Method of Raising Lucerne.

BY

G. R. Mahajan, B. Ag.,
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* * *

LUCERNE (*Medicago sativa*) is a native of Western temperate Asia and is apparently found wild in Afganistan and Baluchistan. Although its home was quite near to India, it is strange to find that its introduction into this part of the country came through Western sources. The Marathi name विलायती गवत (*Vilayati Gavat*) which it has received, proves the above assumption.

Lucerne in western India was at first only grown by the military and stud farms and as its use, hitherto, has been chiefly restricted to horses and its cultivation was located only near Cantonment and big cities. Being a very concentrated food even when green, its use for working animals, if given in moderate quantities, say ten to fiften pounds per head per day, has been, however, found to be quite economical in the feeding of cattle. There is a general belief that lucerne when fed to milch animals reduces the flow of milk. But this is not true. Last year about a dozen milch cattle of the Agricultural College Dairy, Kirkee, were fed on lucerne in considerable quantities for several months and it was found that this had no effect on the flow of milk; the quantity remained the same throughout. Abroad it is not uncommon for milch cattle to be grazed on lucerne pastures throughout the year. Its use therefore even for milch cattle is advantageous.

The area under lucerne is constantly increasing and will do so much more in the future, when working cattle, as well as milch ones get a regular ration containing this fodder. In order that the people, wishing to raise this crop in their fields economically and successfully should know the proper method of doing so, I have given the method below in detail, with my recent experience of it at H. E. the Governor's fodder farm at Kirkee, for their use.

This crop requires a well drained soil rich in lime and reasonably free from weeds. When once established it lasts from ten to twelve years in its own home but in India for only three to four years. Lucerne has a very deep root system. In some cases the roots measure over fifty feet, and when favourable circumstances are available this leads to lucerne being raised as a dry crop for ten to twelve years. In India, specially in the Deccan, conditions are different. There are very few areas of well drained soil which are more than three feet deep, and the root system therefore does not develop to such an extent. Consequently it has to be raised on artificial irrigation almost throughout the year. Besides, the flat bed system which is common all over, does not afford an opportunity to earth up the plants when old, in order to prolong its life. No crop in the Deccan therefore lasts for more than three or at the most four years.

The seed rate required for the bed system (about forty pounds per acre) is so heavy that seed alone at the current prices costs Rs. 100/- per acre. In fact nearly three quarters of this quantity is simply wasted as only one quarter of the plants are left after six months, which throw out branches at the crown. The remainder die of suffocation.

The most laborious task in raising lucerne is to keep the fields well clean of weeds and for this constant weeding after every cutting is necessary. In the bed system manual labour has only to be depended on for the purpose. But in these days when labour is scarce and dear the operations are neglected telling heavily on outturn and longevity.

In order therefore to obviate all these difficulties the ridge and furrow method, has been found very successful after a number of trials. This method is described below.

The land selected for lucerne should be grown with *san* (*Crotolaria juncea*) the previous *kharif* season, and the crop buried in by the beginning of September. The land should be ploughed again by the middle of October, and thoroughly pulverised. This method kills all the annual weeds and keeps under check the perennial weeds, thus giving a free chance for lucerne to start and leaving only a few weeds, to be picked out later on. In case *san* could not be grown as suggested the land should be ploughed soon after the rains, given a heavy application of about forty cartloads of farm yard manure per acre and thoroughly mixed in. After the land is prepared ridges should be formed along the contour lines eighteen to twenty four inches apart, on which the seeds should be sown at the rate of ten to fifteen pounds per acre in a groove made by the sickle along the top, and the earth pressed down to a thickness of not more than one and a half inches. Water channels at convenient places should be opened.

The first and two subsequent waterings should be given very carefully and at very short intervals. The seed having been put on the ridge, it may happen that sufficient moisture required for germination does not reach the top and sometimes germination is delayed for even a month if not properly irrigated. In some places the seed gets a little moisture and begins to germinate but for want of enough moisture for further development it afterwards dies out. As far as possible it is therefore essential to completely soak the ridges at the first watering and in order to do this two ways are suggested below.

(1) Instead of letting in the full flow of water in one furrow as usual, divide it into 5–10 small streams and turn them in separate furrows. The water thus passed soaks the ridges completely.

(2) Put temporary dams of grass or any other rubbish at convenient places so that water may overflow the ridges. Where this cannot be conveniently done, extra labour should be employed to splash water on the ridges. This care is only necessary for the first and two subsequent waterings till the seed sends down its roots sufficiently deep. Under careful management the first method is preferable. To regulate the currents tin sheets with holes one to one and a half inches in diameter may be used. Bamboo tubes can also be employed.

Subsequent waterings may be given to the crop every tenth day in cold weather and every eighth day in the hot weather where canal water is available. On well irrigation these intervals should be eight and six days respectively. After every irrigation either the hand hoe or the bullock hoe should be worked to remove weeds, conserve moisture and aerate the soil.

The first cutting should be made when the side branches appear at the bottom of the plants which generally takes about six weeks from sowing and subsequent cuttings when about one fourth of the crop is in flower. Being a very heavy yielder, it should be given a dose of well rotten farm-yard manure, ten loads per acre, at least once in three months. Other manure such as cakes and minerals were not found economical. Manure when applied can be worked in by the hoe in this method and when necessary rows can be earthed up by the Planet Junior hoe with the wings put on. The method recommended thus saves seed and labour to a considerable extent.

The outturn of lucerne by this method has in no way been found less than by the bed method which will be seen from the following figures obtained at the Manjri Farm.

Date of sowing	Date of grubbing up.	Period it lasted.	Total outturn Per acre	Number of cuttings.	Average per cutting.
		Y. M. D.	lbs.		lbs.
12-7 -12	26-8-15	3 3 25	1,68,277	37	4,541
23-8 -13	4-10 16	3 2 13	1,78,616	29	4,560
12-10-16	Still	growing	65496 for one year.	12	5,458

At Ganeshkhind attached to H. E. the Governor's Dairy is a small farm of sixteen acres. When Dr. Mann and myself took it over for management in last November, there was already growing a crop of lucerne on four acres, all in beds. On account of the heavy charges of weeding, the crop was often neglected. In some places it was full of weeds and on the whole it was not very satisfactory.

A new plot of six acres in one piece was selected for putting in new lucerne. The land had already received farm-yard manure at the rate of twenty loads per acre and one ploughing. A few harrowings were given to remove annual weeds which were appearing here and there. A few patches of *lavala* and *hariali* were dug up by employing extra labour. The plot was thus made practically free of weeds. It was then surveyed and levels taken and ridges formed along the contours by the small ridging plough of Ransomes, two feet apart from centre to centre. Water channels some at every 200 feet and some at 100 feet were opened by the same plough. Only the ends of these furrows had to be repaired by coolies. The total cost of making the ridges ready for sowing these six acres came to about Rs. 12 i. e. Rs. 2 per acre.

The following number of labourers was employed for sowing:—

8 women to open up the grooves along the tops.

Note.—In bed system 4000 lbs. of lucerne is considered to be the best average per cutting.

2 men to put in the lucerne seed.

4 women to cover and press down the earth.

Two days were required to finish up sowing of six acres for the above staff. Their wages amounted to Rs 6 i. e. Re. 1 per acre.

The seed was seen coming on the third day after the first irrigation. Some gaps were seen at the second watering which were thoroughly soaked and then they germinated well. In one corner where the land was uneven, in places seed germinated but died for want of sufficient moisture. This portion was resown.

In a portion of the plot numerous weeds appeared but they were grubbed up easily and in time by means of the Planet Junior hoe worked by two bullocks and one man. To do this by hand more than fifty women labourers would have been required.

This plot is now quite clear of weeds and no extra labour is employed. The bed method plot which is close by has always to be weeded by employing extra labour.

A word about the selection of seed for sowing would be opportune here. It is always best to purchase seed from local growers as it has been found by experiments that local seed comes up and stands well in the same region. One would therefore be benefited even it one has to pay higher price for such seed.

In lucerne seed three colours are generally noticed (1) brown (2) yellow and (3) green. Green ones are the unripe seeds and should therefore be removed. Germination tests of all these kinds were taken and following are the results obtained.

GERMINATION REPORT.

Kind of seed	Date of sowing	Numbers of seeds Germinated on				Total germinated out of 100 seeds.	Remark.
		6–3–18	7–3–18	9–3–18	12–3–18		
Yellow	5–3–18	85	5	4	1	95	94·5 p. c. average
Duplicate	do.	75	15	4	...	94	
Brown	do.	2	9	...	...	11	13 p. c. Average
Duplicate	do.	3	12	...	...	15	

Yellow seed is therefore the best in every respect. While purchasing lucerne seed, therefore, one should always prefer a sample containing a larger number of yellow seeds.

Rosha Oil Industry in Khandesh.

BY

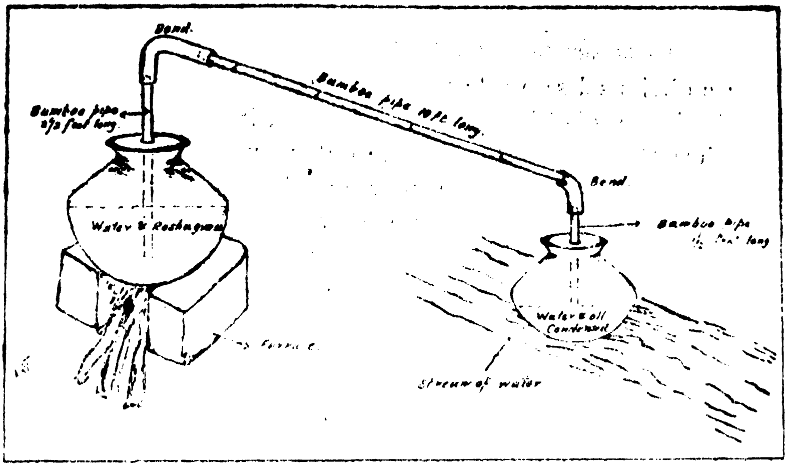
V. V. Gadgil, B. Ag.

* * *

IN the Khandesh district *Rosha* grass is grown on a large scale in the forests of the Satpura Hills and oil has been extracted from this grass for many years. Two kinds of grasses are commonly grown in the jungle viz. (1) *Motia* and (2) *Sophia* and both of these varieties are generally called *rosha* grass. In appearance the blades of these two varieties are quite alike and only a trained eye is able to distinguish them. *Rosha* is largely grown in the Akrani mahal (Dhadgaon Peta) of West Khandesh and also in the Navapur Peta. In other talukas of the Tapti valley viz., Nandurbar, Shahada, Taloda and Shirpur it is found in limited quantity. Every year the *Rosha* grass is sold by contract and it fetches to Government from Rs. 8000 to Rs. 10,000/- annually.

Formerly the *rosha* oil was purchased by merchants from Cawnpore (U. P.) at a very cheap rate and the Khandesh people did not think it sufficiently lucrative to develop this industry on a large scale. But since the oil is being exported to Europe at a higher rate, there is a very keen competition among the contractors for extracting this oil. Sometimes the bidding is so high that it seems as if there would hardly be any margin for the extractors.

This industry is almost entirely dependent on the Bhils-the aborigenes of the Satpura Hills,-who collect the *rosha* grass from the forests and also attend to the extraction of oil. The contractor is required to engage a gang of Bhils for this work and they are paid a fixed amount for every hundred bundles of this grass. The usual rate is one anna per 100 bundles. The bundles are very small only two inches in thickness and from a thousand to twelve hundred bundles are boiled for each boiling. These bundles are put in a big iron or copper vessel which is nearly half filled with water and the distillation is commenced by putting fire under this pot. This copper vessel is about four feet in diameter and is tapering at the mouth. The height from the bottom to the top of the pot is 4½ feet. The mouth of this pot is closed by a lid which has got a small hole for inserting a vertical bamboo in the big pot. This bamboo tube is connected to a slanting pipe by means of copper bend and the other end of this slanting pipe is inserted in anotner big pot which is usually kept in a stream of water. The steam mixed with oil vapour is condensed in the second pot and the distillation lasts for three hours. The completion of the oil-extraction is generally known by the hissing sound when the fire is extinguished and fresh water and grass are added to the pot for a second boiling. The mouth of the pot and the connection of the bend and the tubes are besmeared with *udid* paste to prevent the escape of steam. If the supply of grass is sufficient six boilings are taken per day (three by day and three by night) and as stated above all the operations are carried out by *Bhils*.



As the process requires an abundant supply of water, usually the furnace is located just near the brook and the second pot is placed in the current of water for the condensation of steam and oil-vapour. As the labourers have to work in water throughout the whole day, they naturally suffer from cold and malaria and the Deccani *kunbis* are quite unwilling to work in the distillation factory. The oil from the condensing pot is separated by stirring the liquid with a big rod and allowing it to rise to the surface of the water. This is a very dangerous operation and the labourer is likely to suffer from the noxious vapour and contact with the *rosha* oil. It is reported that a good many people have been so seriously affected as not to recover for many moths. On the other hand I have seen the *Bhils* taking their bath in the residue of the distilled water in which a slight percentage of oil still remains and they are under the impression that some of their diseases like cold, gout etc. are cured by bathing in this liquid.

The obvious disadvantage of this process will be seen that a part of this grass is likely to be burnt when it comes in contact with the surface of the big pot above the water level. And if the quantity of water is increased the energy required for boiling the same is largely wasted and this is the reason why the quantity of oil obtained from each boiling varies according to the quantity of water (although the bulk of the water is the same). In my opinion this draw-back can be removed by modifying the apparatus and using two separate chambers one for boiling the water and the second to contain the grass. The bundles of *Rosha* grass should be placed in the latter and the steam from the first pot should be allowed to enter at the bottom of the vessel containing the grass. From the upper surface of this vessel another pipe should be taken to the condenser, which should be modified so as to secure more perfect condensation.

Another defect is seen in the construction of the furnace in which there is no air passage for the complete combustion of the fuel and if a new furnace is constructed after the Poona Gul-boiling pattern I think there will be much saving of fuel. For the present the Forest Department allows the use of fuel to the contractors free of charge and therefore this question of fuel does not appeal to them.

For the present we do not know what percentage of oil remains in the grass or in the distilled water after the boiling and extraction is completed. Further it is not known whether the quality of the oil is impaired by burning a part of the grass above the water level and these two points are really worth investigating.

The operation of extracting *Rosha* oil is generally commenced in the middle of August and lasts for two to two and a half months. When the grass comes into flower it is supposed to be fit for boiling. Fresh grass is always preferred as it contains more oil but if the grass is to be brought from a long distance, grass eight days old will serve the purpose. Now looking to the economic side of this industry I may state that the following are the approximate expenses for each boiling :—

Cost of 1000 or 1200 bundles of rosha grass ...	Rs.	0-12—0
Cost of *Udid* flour	,,	0—2—0
Cost of collecting wood which is given free of charge by the Forest Department	,,	0—2—0
Cost of labour required for boiling and separating oil	,,	0—4—0
Total	Rs.	1—4—0

The cost of erecting the furnace, the hire of pots and the cost of bamboo tubes etc. will not exceed more than Rs. 25 for a period of two months. With these expenses the extractor gets three quarters of a pound of oil per boiling if the operator is careful enough and if the adjustment of the water is properly made ; otherwise he will secure only half a pound oil per boiling. The oil is sold in the Bombay market at Rs. 5 or Rs. 6 per pound and brings a profit of Rs. 1-8 - to Rs.3 - per boiling. From this profit he has to pay the Government duties settled by contract.

From the above description it is worth while to try the extraction of *Rosha oil* with an improved apparatus and if it proves successful there is a wider scope for developing this industry throughout the whole of Khandesh.

Successful Introduction of a dry crop of Big Japanese Groundnut in the Prantij Taluka of Ahmedabad District.

BY

G. P. Pathak, B. Ag.

THE chief physical feature of this taluka is that it is completely detached from the main portion of the District. It is surrounded on the West and South by Baroda lands and on the East and North by the Mahikantha.

The average rainfall for the taluka is about 33.2 inches (average of 11 years ending 1902) but it varies a good deal and is sometimes very much higher. In the last few years it has varied from 7.69 inches in 1911 to 44.4 inches in 1906. The rainy season generally begins by about the middle of June and after fairly heavy rains in July gradually closes by about the middle of September. The range of temperature is very great in the cold season (November to February) and from March until the rains begin, the wind in the day time is extremely hot. October is the least healthy month the climate being close and feverish.

The soil of the taluka is almost entirely composed of a sandy loam, though in parts there are stretches of black soil. Further, in the north east part of the taluka a red stony soil like that of parts of the Deccan is also to be found.

Water is found at a depth of twenty to thirty feet along the side of the canal. The Bokh reservoir and the Hathmati canal are the two irrigation works in the taluka and paddy is grown on a large scale. The other *kharif* crops are *bajri*, *jowar*, *till*, castor and pulses, namely *math*, *mug*, *udid*, *guvar*, *san* and a few others. The practice is also common of taking gram, rape, *methi* and wheat as *rabi* crops in rice or fallow lands with the help of one or two irrigations with canal water.

It will therefore be seen that in the taluka a large variety of crops is grown and as there are irrigation facilities in good years people take both rice and *rabi* crops in the same land. However, in years of scanty rainfall the canal flow is uncertain and very limited. The natural consequence of this is that both men and cattle suffer very seriously in years of drought due to the absence of well irrigation.

When I had the first opportunity of visiting this taluka in May 1913 (to make preliminary inquiries into the local agricultural conditions and to suggest possible improvements) I was told by the cultivators that they would like to grow a *kharif* crop that did not require any irrigation and would bring some money. The people were often afraid of famine conditions as they had lately experienced there in 1911 when it had only rained 7·69 inches. Moreover, there is the practice of keeping too many cattle on the belief that the soils there require much manuring, the animals being very largely kept as producers of manure. Under the existing conditions of precarious rainfall and the difficulty of maintaining the cattle a crop that would give money and fodder required consideration. It was, therefore, suggested that groundnut was a crop which would yield a large quantity of a very valuable fodder and would bring at the same time a good monetary return in comparison with the local leguminous crops such as *math*, *guvar*, *san*, etc. As a happy result of the successful demonstrations in the early part of 1913 some cultivators were induced to try Spanish groundnut and thereafter nearly fifteen maunds of seed was distributed. The season of 1913–14 was fairly good and the crop gave some hopes though it was damaged by field rats, white ants, and pigs. Thus the people got some experience with the cultivation of that crop in the first year. As the Spanish peanut did not fetch a good price in the market due to the small size of the seed of this variety and as the yield was also rather poor the people was advised to try "Big Japanese" groundnut as a crop because the bigger variety was much appreciated in the market and was likely to fetch a good price. It gave a high yield of nuts during the second year and the people were satisfied with its cultivation.

The area under this crop gradually increased in surrounding villages of the taluka. The appended acreage statement with the number of villages in the taluka under the groundnut crop (exclusive of the Idar and Gaikwar territories and the Mahikantha) will show the steady progress of this crop.

Year.	Number of villages.	Area in acres.
1913-14	23	35·18
1914-15	19	193·20

Year.	Number of villages.	Area in acre.
1915-16	27	725·09
1916-17	42	1480·19
1917-18		5586·19

It will now be seen that the crop has become completely established in the taluka and the people have so much liking for this crop that in the very near future the area will rise to its maximum and the crop will occupy the area that previously grew *math*.

A short account of its cultivation requires to be given and it may be stated that the crop is grown in poor sandy soils. The fields are worked twice or thrice with a country wooden plough and harrowed. The seed is either dibbled at two feet apart or dropped after the plough in every alternate furrow (that is to say at about eighteen inches between two consecutive rows) by about the end of June to the middle of July. The seed rate varies from 20 to 35 lbs. unhusked nuts per acre though husked kernels do much better. The crop requires one hand weeding and two interculturings. Thereafter it does not require any operation except that it is to be guarded against damage by wild pigs. The nuts ripen after four months and a half or a little longer, that is to say by about the middle of November and it is harvested by first uprooting the plant and hand digging with a *kudali*. The average outturn per acre comes to 800 lbs. and in good fields up to 1200 to 1600 lbs. per acre. It sells at about Rs. 2/-per forty pounds, and may sell at Rs. 2-8-0 if the demand is great. This year from Sonason station alone nearly 7000 bags of groundnut were booked, and large amounts were also sent from Prantij and Talod stations.

In conclusion, it, may be well to enumerate a few of the many advantages derived from this crop :—

1. It is a dry crop and does not require any irrigation in ordinary seasons.

2. It is a money-bringing crop as the nuts sells at a higher price than all other leguminous crops grown in the taluka.

3. It is a good fodder crop in years of scanty rainfall as it yields a good nutritious fodder for cattle.

4. It is a leguminous crop and has the property of fixing atmospheric nitrogen of the air in the soil. It thus leaves the soil richer after taking the crop by adding to it the most important plant food, namely nitrogen from the air.

5. It has a training habit and thus smothers weeds.

6. The land gets the advantage of additional tillage while up-rooting plants and digging out nuts.

7. It is a good rotation crop with *bajri*, *jowar* or cotton.

8. The crop yields an edible oil when the nuts are pressed and gives the most important concentrated food for the milch and work cattle in the form of cake and also a valuable manure rich in nitrogen when applied to the soil.

Botanical Features of Mahableshwar.

BY

M. Ezekiel, B. Sc., B. A.

A short tour to Mahableshwar was made in March 1917 and plants flowering at the time were collected. In the following short account of the Botany of Mahableshwar, excepting a few, only the plants flowering at the time are referred to.

The special features of the Botany of Mahableshwar begin as we ascend the steep *ghats* leaving the city of Wai behind. As we ascend the ghats, almost the first thing that attracts the eye of the Botanist, is the immense number of petrophytes growing along the steep valleys, and sending their powerful roots in rock-crevices and ultimately splitting them. These petrophytes are seen projecting from the barest rocks without even a trace of soil for the supply of nutriment to these plants. Among these may be mentioned *Woodfordia floribunda*, with leaves tinged with red, and scarlet flowers, and *Kalanchoe Bhideii*, named by Cook after Mr. R. K. Bhide, keeper of the Herbarium at Poona. The Thymeleaceous *Lasiosiphon* with numerous bunches of silky inflorescences and the Labiatous *Pogostemmon* also meet his eye. As he ascends higher, the commoner and more familiar plants are left behind. Woodfordia is no more to be seen, and new species characteristic of the great altitude meet his eye.

As he approaches Panchgani, he is greeted by beautiful hedges of wild roses flowering in profusion, and the athletic Agaves, with gigantic hat-stand-like inflorescences "Present arms". As he approaches the Post Office, he meets with numerous members of the orders Rubiaceae, Lauraceae, Melastomaceae, Sapotaceae, Eleagnaceae, Styracaceae. Piperaceae and Myrsinae all hurly burly.

The vegetation of Mahableshwar may be said to be arranged in several layers. The lowermost layer consists of herbaceous plants, grasses, and shade-loving shrubs. These belong to various orders. Of Acanthaceæ we find, *Blepharis*, *Strobilanthes*, *Haplanthus*, *Rumgia* and *Dicliptera*. Of Compositæ we find the *Blumeas* clad in silk, *Conyzas* and *Vernonias* growing plentifully all over while the desert loving *Echinops* practising penance in the driest situations, in spite of a rich supply of water and nutriment available all over the area.

The second layer consists of shrubby plants and small trees. The third layer is made up of large trees covered with a felt of liverworts and mosses and the lichen-like orchid *Jra lichenora*. Among the lianes may be mentioned *Clematis*, *Jasminum* unfortunately attacked by rust, *Ligustrum*, the ill-natured *Tragia* with stinging hairs, *Dioscoreas*, *Gymnema*, *Hoya* and *Piper Hookerii*.

The profusion of epiphytic vegetation and Ferns is a striking evidence of the extremely humid climate of Mahableshwar. Among the epiphytic Orchids are seen *Dendrobiums*, *Iria*, *Æridis*.

The following are sciophylls commonly found there :—

Bryophyllum calycinum.
Canscora diffusa (White and pink).
Rubia cordifolia.
Hoya carnosa.
Lobelia nicotianifolia.
Kolebrookia oppositifolia.

The following plants were found in flower in March :—

Ranunculaceæ	*Clematis Gouriana* Roxb.
Capparidaceæ	*Capparis pedunculosa* wall. var. *longispina* Hook.
Bixaceæ	*Flacourtia* sp.
Pittosporaceæ	*Pittosporum dasicaulon.*
Olacaceæ	*Mappia fœtida* Miers.
Celastraceæ	*Gymnosporea montana* Lawson.
,,	*G. Rothiana.*
,,	*Eleodendron glaucum.*
Rhamnaceæ	*Scutia indica.*
,,	*Zizyphus rugosa.*
Leguminosæ	*Atylosia lineata.*
Combretaceæ	*Terminalia Chebula.*
Melastomaceæ	*Memecylon edule.*
,,	*Osbeckia sp.*
Rubiaceæ	*Plectronia umbellattum.*
,,	*Rubia cordifolia.*
,,	*Randia dumetorum.*
Compositæ	*Ageratum conyzoides* Linn.
,,	*Conyza stricta.*
,,	*Vernonia divergens.*

Companulaceae	*Lobelia nicotianifolia* Heyne.
Myrsineae	*Embelia robusta.* Roxb.
,,	,, *ribes* Burm.
,,	,, *viridiflora* Scheff.
Sapotaceae	*Sideroxylon tomentosum* Roxb.
Styracaceae	*Simplocos Bedommi.*
Oleaceae	*Jasminum malabaricum.*
,,	*Ligustrum nilgirence.*
	var. *obovata.*
Asclepiadaceae	*Hoya carnosa.*
,,	*Gymnema sylvestre* R. Br.
Gencianaceae	*Cansoora diffusa* Linn.
Solanaceae	*Solanum giganteum.*
Acanthaceae	*Strobilanthes exiocephalus.*
,,	*Dicliptera zeylanica.*
Verbenaceae	*Callicarpa lanata.*
Labiatae	*Colebrookia opoositifolia Sm.*
,,	*Leucas ciliata* Benth.
,,	*Pogostemmon parviflora.*
Polygonaceae	*Polygonum chinensis.*
Piperaceae	*Piper Hookerii.*
Lauraceae	*Litsia Stocksii.*
Thymeleaceae	*Lasiosiphon eriocephalus.*
Eleagnaceae	*Eleagnus latifolia.*
Santalaceae	*Osyris arborea.*
Euphorbiaceae	*Glochidion lanceolarium.* Voigi.
,,	*Tragia incolucrata* Linn.
,,	*Euphorbia elegans Spreng.*
,,	,, *hypericifolia* Linn.
	var. parviflora Hook.
,,	*Mallotus Phillipensis* Muell.
Orchidaceae	*Æridis crispum.*
,,	*Dendrobium barbadulum.*
,,	,, *microbulbun.*
,,	*Iria lichenora.*
Graminaceae	*Anthesteria ciliatia.*
,,	*Arundinella variagata.*
Cyperaceae	*Carex mercarensis.*

Power on the Farm.

BY

K. B. Kelkar,

Superintendent, Agricultural Engineer's Workshop, Poona.

THE whole world is dependent on the farmer and if he cultivates his land in an efficient manner and produces a greater quantity of grain, people will get the grain at a lower cost. To accomplish this, the farmer must get labour at as cheap a rate as possible. But, instead of this, the cost of labour is regularly increasing, without any corresponding improvement in its efficiency. Of course more work and better work on every available acre cannot be expected unless the cultivator receives a better agricultural education. As the case is at present, however, the shortage of labour must be met by machinery and the farmer of the future must be a mechanic rather than a day labourer. When he has the machinery, the greater part of the manual work can be done by wheels and levers. Hand labour was long ago dispensed with in the mills and factories wherever possible, because it could not compete successfully with that done by machinery. The farmer, however, has not followed the example of the mills and factories, but has adhered to the old methods in his farm work, instead of using some farm mechanism which can adequately do the work cheaper and better.

The call of the farmer must be for power–some means by which a single man can do the work for which a dozen or more men are at present required. In these days the old idea of farming for a bare living is not sufficient. It must assume the form of a commercial project. A certain amount of work usually done by hand can be done by machinery in a comparatively short time.

There are various forms of farm mechanism :—

(*a*) The tread mill which is not a real power, but a clumsv way of transmitting the limited energy of some animal. It is unsteady, hard to operate and soon becomes a synonym for drudgery.

(*b*) Sweep power which is hard to move and cumbersome.

(*c*) The water wheel which is of very restricted application. It may easily fail in dry weather and at best cannot be moved about.

(*d*) Wind mills which are objectionable chiefly on account of the unreliable nature of their motive power.

(*e*) Steam which has hitherto been the only serious competitor of the bullock in general farm work. It is not by any means, however, an ideal labour-saving device.

The devices enumerated above do not suit every farmer. For his purpose the ideal device must not cost him anything except during the time it is in actual use, and it must be ready at a moment's notice. It must be safe, reliable, easy to operate and portable, not easily disturbed by weather conditions, available at any place, indoors or out. Electricity can be said to possess the above characteristics except the one of portability, but it has not become sufficiently universal to be applicable to the farm. To generate it is a trouble when on a large scale, and there is also a good deal of loss in transmission.

In Western countries the power generally adopted on the farm is the Gasoline Engine as it satisfies all the above requirements. It is a wonderfully flexible power, adapting itself to all conditions. The farmer may start the engine while the cattle are being fed, and can go back to his meals leaving it without an attendant at times. In the case of the steam boiler, attendance, is compulsory and fuel has to be used to keep up steam, even when the engine is stopped for a short period. The gasoline engine is such a handy power that it can be removed to any place wherever required. Supposing there is work near the house, engines of this type can be picked up by a couple of men and taken there to work any suitable machine. They can also be conveyed to the farthest corner of the farm on a wheel barrow very conveniently without the necessity of a second or third trip for water tank or fuel. They will run in almost any weather and can be obtained in ½-horse power size if required. In Western countries they are actually doing the following work–manipulating tractors, ploughing, harrowing, seeding, threshing and hay making, etc.

From the above it might be seen that here in India the best farm power is also the gasoline engine as it fulfils the necessary requirements, but that is not so for the following reasons :

The agriculturist in India has not the remotest idea of machinery. Moreover, there is a scarcity of repairers or mechanics at hand who can put right the defects in the gasoline engine. Now, unless conditions are just right the gasoline engine will stop after running a short time or refuse to work at all. If there is a slight disorder in the magneto, if the sparking plug is dirty, if a wire leaks, or if the carbon brushes are greasy, the engine will not work. Such defects the present agriculturist in India will not be able to locate and remedy. Nor is there the possibility of the help of a mechanic being available even in the villages, for even in cities and towns this help is very difficult to obtain. However, in course of time, with the agriculturist's increased knowledge of machinery, the gasoline engine may prove to be the ideal farm power even in India.

At present however, the best farm power for India is the kerosine engine. It fulfils all the essentials of the ideal farm power above described and has this advantage over the gasoline engine that it has no ignition troubles and a skilled workman is not required to run it. Any ordinary man with the necessary instructions and a few days practice will be able to run it and put matters right if the engine refuses to work. Although the oil engine is not usually portable, portability is not of so much importance to an agriculturist in India as long as all the work on the farm is not being done by machinery. Portability is required when all the operations on the farm are being worked by machinery at different places. Here in India there are very few farms where separate machines are in use and therefore the necessity for the removal of the power to different places will hardly be felt. All the work on the farm such as pumping, sugarcane crushing, chaff cutting, hay pressing, etc., can be done at one place by one oil-engine.

Thus it will be seen that the prime mover for Indian agriculture is the oil-engine and its introduction on the farm will save a good deal of labour to the farmer and add to his profits. There is room for an immediate large extension for its use in Western India.

Reviews.

(1) * *Gava-gada* (गांव-गाडा) *by T. N. Atre*, B. A. LL. B.

This little book of nearly 300 pages written in Marathi contains notes on 'Rural Sociology and Village Problems' with special reference to Agriculture, which are the outcome of a long and intimate acquaintance of the author with village people and the conditions under which they live. Mr. Atre compares a village to a big cart which was once properly arranged and was running smoothly but which is now in a deplorable condition on account of its being neglected and overcrowded. In these days of advancement we are thinking of introducing reforms to improve the condition of our society but none of these reforms penetrate the limits of villages. A village was once a self-sufficient unit which had a headman, a priest, its own artisans and its own men to protect it. As long as it paid its revenue to the central government through the proper officers it was free to manage its own internal affairs with the help of a '*Panchayat*.' All the offices and vocations, which naturally became hereditary, can be divided into three classes. In the first class we have those offices and vocations that are useful both to the Government and to the people and as such are paid for either by the Government or by the people or by both. Those in the second class are useful to the people only and are supported by them. A very large number of these vocations have become a burden to the cultivators. The system which once made the village a self-sufficient unit has out-lived its time and many of the functionaries have ceased to be as useful as they were to the cultivators and some of them have proved to be a hindrance to the proper development of the village under the changed conditions.

Hereditary professional beggars have become a regular pest on the cultivators. Some of these go to the villages to carry on small trades; others go under some religious pretext; while still others go there for the recreation and amusement of the cultivators. Some beggars, especially those belonging to the wandering and criminal tribes exact their alms even with threats.

The cultivators are at their best at the time of harvest and therefore this is the time when they try to meet all the demands on them. But even at the time of the harvest they are not their own masters. Many times they have to sell their crop to the *Savkar* or money-lender. Big European companies sometimes advance money to the cultivators to grow particular crops which they buy even before harvest. If the crop is not sold as above the cultivators, being hard pressed for money especially for paying the assessment, &c. have to carry the produce to market immediately. None of these ways is economical, even when the business is carried on honestly, which happens but seldom. The cultivators have to sell their corn cheap and buy the same corn again late in the season at enhanced rates. That is why corn is cheaper in towns than in the villages where it is produced. Very few cultivators are free from the clutches of the *Savkars*. The cultivators and the *Savkars* both try to deceive each other but ultimately it is the *savkars* that deceive the ignorant cultivators. Many instances can be shown where a *bania* or a *marwari* has risen, within a period of ten or fifteen years from a state of beggary to that of a big landlord.

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* Printed at the Aryabhushan Press, Poona, Price Rs. 1-4-0.

The economic condition of the cultivators has changed since the establishment of the Salt and Forest Departments. Not only they cannot get fuel from the forest or graze their cattle there, but they have to support those who in former days maintained themselves on the forest produce or by hunting, without any return. Pigs and deer have increased beyond control and the ignorant cultivators see no way out of their present deplorable condition.

The future of the cultivators does not seem however to be hopelessly gloomy. Agricultural Departments are opened all over the country in order to improve the condition of Indian agriculture. Colleges and schools are opened for higher agricultural education. Agricultural shows and demonstrations are bringing light to the cultivators and co-operative societies are helping to relax the economic strain on them. The field is vast and much must be done before any appreciable results can be seen. All possible forces should be brought to bear on this subject both by the Government and the people. Mr. T. N. Atre has done a great service to the Marathi reading public by publishing this original work,—the first of its kind in Marathi literature.

(2) *Land and Labour in a Deccan Village* by Dr. H. H. Mann and his assistants.—This little volume of 177 pages is the first of

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* Published by Humphrey Milford, Oxford University Press, London and Bombay, Price Rs. 2.

the economic series to be published by the University of Bombay. The question of the present condition of Indian villages has been before the public for a very long time but no detailed and correct information is available to express any definite opinion with regard to it. It occurred to Dr. Mann to make a beginning in collecting information, and therefore he selected a village-Pimpla Soudagar near Poona-representing those villages whose rainfall is chiefly in June and July and a considerable proportion of whose crops are grown during the rainy season. The enquiry, which extended to land and waters, crops, and cattle, and finally to the people of the village themselves, was carried on on sound and scientific principles. It is only those who know how very difficult it is to get correct information from villagers steeped in ignorance and superstition, will understand the importance of such a task. Dr. Mann and his assistants therefore must be congratulated for having successfully achieved it.

The old records of Pimpla Soudagar from the year 1699 onwards show that excepting the usual *inams* of *patil*, *kulkarni*, and *mahars* the whole revenue went to the Government till the year 1819 when the village was given as an *inam* to one Rango Pandit Khole and his descendants for his services to the British Government. The total assessed revenue increased from Rs. 801 in 1770-71 to Rs. 1158 in 1811-12 and to Rs. 1660 in 1914-15. Some of the items of expenditures given in the old records are very interesting. Feasts to Government servants, gifts to poor travellers or presents to messengers, all occur, in short, whatever was spent for the village as a whole was charged to the public treasury. The number of cultivators owning land was only 19 in 1770. It rose to 35 in 1791, fell to 28 in 1797 and then went on increasing till it reached 156 in 1914. This increase has naturally made the area per family very small but the worst feature of it is that the land belonging to one family instead of being held in one plot is held in separate small plots distributed all over the village, which is extremely uneconomic.

The most important crop of the village is *jowar* and the other crops are *bajri*, wheat, pulses and oil seeds. When there is more rainfall than usual they grow rice in a few fields and sugarcane in some fields irrigated by well water. Carrots and peas are comparatively recently introduced and many of the old wheat fields now grow *jowar*. These changes show that although people are slow to move they are not stationary and if they are shown the way they will move in the right direction.

At the time of the census there were 60 cows and 36 buffaloes and about 120 lbs. of milk was consumed in the village with a population of 550. The number of bullocks was 105 for 1065 acres, that is just sufficient to cultivate the land.

The chapter on 'The people of the village' is exceedinagly interesting. In 1914 the village had 111 families with a population of 556. The number of children being less than the adults shows that the population is not increasing. The condition of the people is not satisfactory. Out of the 103 families whose detailed information could be got eight families can live on the income from land, 28 can pay their way by supplementing the income by labour while the remaining 67 families find it difficult to maintain themselves even by working as labourers to supplement what they get from land. The total debts of the village amount to Rs. 13,314 paying interest to the extent of Rs. 2,592. The total income of the village including every item comes to Rs. 22,459 while the necessary expenditure according to the standard of the cultivators comes to Rs. 22,501 excluding interest on the debts. This brings out the fact that even if all the debts of the village are paid off they can barely maintain themselves even in good years and that a single bad season is sufficient to disturb the balance and push the village further into the state of indebtedness. The population has increased but the outturn from land is what it was. The position is bad enough but the authors are not sure whether such is the conditions of the other dry villages. Their enquiries are going on and before long they may be able to place further information about the condition of the villages before the public and suggest remedies to improve the present disheartening conditions. The book is inspiring and is an excellent guide to those who want to work out the economic problems of India and not merely play with figures published in Government reports.

Establishment and Management of the Dairy Farm by G. K. Kelkar (Bulletin No. 86. Department of Agriculture, Bombay 7 annas).

A new edition of Rao Bohadur G. K. Kelkar's bulletin on the management of a Dairy Farm in India has long been demanded. And at last it is forthcoming, and forms one of the most valuable contributions yet made to Indian dairy management. One may recall the fact that the authour of this bulletin was manager of the Government Civil Dairy, Poona (now the Agricultural College Dairy) in its most palmy days. He has been ultimately connected with the management of dairies almost ever since, and the practical information he can give on the subject is probably based on as much experience as has fallen to the lot of most men in India.

The bulletin before us is essentially practical. It condenses into a small compass a very large mass of information which either does not exist elsewhere, or else is very difficult to get at. Whether one comes to it to find the correct ration for a milking cow or buffalo in India, the probable yield of milk from animals of different types, the character of dairy buildings most suited to Indian conditions, the equipment necessary for an Indian dairy, or the profit which should be made from dairies of different sizes,-information will be found within the pages of this exceedingly valuable contribution to the literature of the subject.

Reviews of some new books in the College Library.

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AGRICULTURE.

A. 1347.—Twenty lessons on Poultry by Pallisson of the American Poultry Association. A very useful book for a student of Poultry School teachers might get hints from it.

A. 140[illegible].—Productive plant husbandry by Kary C. Davis. Up-to-date methods of growing field crops, of gardening and of fruit growing are given with illustrations. Reference Book for a student of intensive agriculture.

A. 1404.—Cotton and other vegetable fibres by John Murray. A student interested in Cotton cultivation will be benefited by reading this.

BOTANY.

B. 945—Gardens of the Great Mughals by C. M. Villiers Stuart 1913. Specially interesting to students of Applied Botany in their study of Ornamental Gardening.

B. 947.—" Structural Botany" by Harendra Nath Mitra. 1912. A text-book of Indian Botany specially written for Bengal students and illustrated with Bengal plants; may be consulted with advantage by first year students. The internal structure of plants is treated particularly clearly.

B. 949.—A Critique of the Theory of Evolution by Thomas Hunt Morgan. A review of the old and new evidence for evolution; useful to students of plant breeding.

CHEMISTRY.

C. 916.—'The Chemistry of Farm Practice' by T. E. Keitt. A very useful and interesting book for the B. Ag. students. It deals not only with those subjects which are ordinarily included under Agricultural Chemistry but also with such matters as the Insecticides, Fungicides, Fire extinguishers &c. The book is written in a simple style and has been made attractive by a large number of pictures.

C. 919.—'Soil Biology Laboratory Manual' by A. L. Whiting, is a small book which will be useful as a guide to beginners in the study of soil biology.

C. 923—'A Class-Book of Organic Chemistry' by J. B. Cohen. This book has filled a long-felt gap between this author's Primer on Organic Chemistry and his 'Theoretical Organic Chemistry.' This book is suitable in every way for the students of the Intermediate Agriculture class. As is usual with the author he has treated the subject in such a way that the students will find it easy to grasp the subject.

C. 927.—'A Course in Food Analysis' by A. L. Winton. This is useful as a reference book to those students who take Chemistry as their optional subject.

C. 934.—'A Laboratory Manual of Biological Chemistry by Otto Folin. This is very useful as reference book in higher practical chemistry. The chemistry students will derive much help from it in their work.

C. 935.—'1001 Tests of Foods, Beverages and toilet accessories, good and otherwise' by H. W. Wiley. This book gives a general idea as to what substances are present in the various articles sold by well-known companies. It :will satisfy the curiosity of inquisitive persons with regard to the various things put on the market.

C. 936.—'Practical Chemistry for Intermediate classes' by H. B. Dunnicliff, is a good guide in the practical chemistry work of the Intermediate Agriculture class.

'The G. D. Mehta Memorial Prize Fund.'

AT the desire of several friends of the late Mr. G. D. Mehta and many of the Gujarati students of the College the undersigned took the responsibility of collecting funds to institute a prize to the memory of one of the best students of the Poona Agricultural College, who was removed in the prime of his youth by the cruel hand of death.

In July last an appeal was sent to all the Agricultural Graduates to subscribe to the above fund. About 250 letters and 50 reminders were sent but only 48 persons responded to the appeal and a sum of Rs. 564 was collected in six months. Nineteen rupees were spent on printing, postage &c. and a net balance of Rs. 545 will be handed over to the Principal of the Poona Agricultural College, who has kindly consented to give annually, from the interest of the above amount, a prize to the student who stands first in Compulsory Agriculture at the B. Ag. Examination of the Bombay University.

Some of the Gujarati friends of the late Mr. Mehta, have promised to send a handsome donation towards the fund, which will be duly acknowledged and added to the sum already collected.

In conclusion the undersigned tenders his sincere thanks to all the subscribers.

D. L. SAHASRABUDDHE,
Hon. Secretary.

The following is the list of subscribers :

			Rs.				Rs.
1	Mr.	S. L. Ajrekar	...50	25	Mr.	M. L. Patel	... 8
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22	,,	T. V. Nagarshet	...10	46	,,	B. B. Jamaspjina	... 2
23	,,	S. V. Shevade	...10	47	,,	Y. R. Joshi	... 2
24	,,	J. G. Naik	... 8	48	,,	V. G. Patwardhan	... 1

The P. J. Bhatt Memorial Fund.

It has been suggested by many of the subscribers of The P. J. Bhatt Memorial Fund that the sum invested in the Post Office Savings Bank in the name of the undersigned as honorary secretary of the above fund should now be transferred to the name of The Principal Poona Agricultural College Poona, who should be made ex-officio trustee of the fund.

This change will have the great advantage of making the fund more permanent and stable; and besides this the working of the fund will be done automatically by the college authorities.

If therefore any of the subscribers of the fund is against this change he should write to the undersigned before the 5th of May 1918. If no objections are received by that time the sum will be handed over to the Principal Poona Agricultural College, Poona, as early as possible after the 15th of May 1918.

V. A. TAMHANE,
Hon. Secretary
Bhatt Memorial Fund.

College Notes.

AT the time of writing these notes we are feeling terribly lonely. The College closed long since. There is no more the bustle and noise indicative of the presence of young men in full enjoyment of health and good spirits. The examinations have likewise come to an end, successfully we hope, to all those who appeared for them. The first year men have all run off home for the enjoyment of a well earned holiday, some of the third year men are still lingering behind, but in a few days the hostel and the premises will be as silent and deserted as a catacomb. To all we desire the best success in their examinations. To the third year men we wish good luck and good fortune in any work they may be called upon to do in future. We shall be glad to record in these pages all the good work that they are surely going to do.

There was a meeting of the staff and students on the 7th February for the distribution of prize cards to our sportsmen. In our last issue we referred to the possible occurrence of a common meeting of all the Poona Colleges for this purpose, but owing to the recurrence of plague and the consequent closing of other colleges, this could not be done. We had, therefore, our own meeting, very well attended by members of the staff and students. Principal Bain of the Deccan College presided and Professor Kale of the Fergusson College was one of our guests, representing the "Our Day" committee. Prof. Bain gave a very interesting address on "Shakespeare". At the end a purse was handed over to Prof. Kale containing our contribution to 'Our Day fund'. Both Prof. Kale and Principal Bain spoke highly of the students of the Agricultural College for declining to accept prizes of the sports and resigning the money in favour of Our Day fund.

A photo was taken of the men who distinguished themselves at the sports.

Gymkhana Notes.

ACCORDING to a resolution passed this year the elections of the Gymkhana office-bearers were to be made before the 10th of February and therefore a meeting of the General body was called on the 4th of February. The room was packed with students and most of the members of the staff also were present. Dr. H. H. Mann was in the chair and the following business was done.

At the beginning of the meeting Mr. Shirgaonkar—General Secretary of the Social Gathering—read his report. After a good deal of discussion the report was adopted unanimously with a vote of thanks to Mr. Shirgaonkar and his colleagues.

On behalf of the Gymkhana Managing Committee Mr. Herlekar moved the following resolution which was passed by a large majority. —" That the students who wish to stand as candidates for the post of the General Secretaryship, should lay before the meeting what they would try and do during their career if they were elected to that position. Those who will not do so will not be eligible for the post."

Then Mr. Herlekar read the report of the Gymkhana for the year 1917 which was adopted with a vote of thanks to Mr. Herlekar and the Managing Committee.

Lastly nominations and votes for the various positions in the Gymkhana were received and the following persons were declared by the chairman as duly elected.

Ex-officio President ...	Dr. H. H. Mann.
Vice-presidents ...	Prof. J. B. Knight. „ S. L. Ajrekar, „ D. L. Sahasrabuddhe.
Chairman ...	Prof. R. S. Kasargode.
General Secretary ...	Mr. C. M. Bhatt.
Secretary for Cricket ...	Mr. G. N. Jog.
„ „ Tennis ...	Mr., Gopal Rao Hardikar.
„ „ Foot-ball & Hockey	Mr. A. A. Khatib.
„ „ Debating Society.	Mr. C. R. Oza.
„ „ Gymnasium ...	Mr. B. B. Mulchandani.
„ „ Reading Room ...	Mr. A. M. Bukhari
Managers of the Magazine ...	Mr. M. N. Kamat. Mr. G. B. Shinde.

The new Managing Committee took over charge of their work on the 10th of February and commenced their work in right earnest by undertaking the preparation of a cricket pitch on our play ground.

SUPPLEMENT.

Gardening in Aden.

Reports on the Supply and Transport Gardens, Shaikh Othman, Aden.

BY

D. S. Corlett, Lieutenant.

Superintendent, Supply and Transport Gardens, Aden.

(We have been very kindly permitted to pubish the two reports on the Supply and Transport gardens at Aden which follow, by the author and also by the Quartermaster General in India. They furnish information with regard to gardening in Aden which, we think, is otherwise unobtainable, and we have very great pleasure in being able to publish them.—H. H. Mann.)

FIRST REPORT (DECEMBER 1916).

Historical—The garden lies about one mile north of the British Arabian town of Shaikh Othman, which lies ten miles to the north-east of Aden. It was started as a garden in 1900 by Major Mathias and Lieutenant Harrison and its area is twenty acres. It is enclosed in a stout mudbrick wall with three gates opening on the main roads. The whole of the garden has never been under cultivation at one and the same time but only the better parts of it in rotation. About six acres are very high and partly unlevelled and have never been cultivated, although dates might easily have been planted and by now have been bearing profitable crops.

There has never been a special superintend ent appointed to run the garden nor the grass-farm which was at one time started to the West where the remains of it and the wells can yet be seen. An attempt was made to let out this land to local cultivators to grow cotton, which can still be found growing there though unattended and unwatered. The scheme was abandoned on the outbreak of war. Thus the garden has been left to the superficial supervision of constantly changing officers in addition to their own duties.

Some of the existing date-palms were imported from Basrah Maculla, and Lahis about 1903. These should be of good varietiesr and their suckers should be propagated, as undoubtedly the propee cultivation of dates in this garden will render it exceedingly profitabl and realise a high price if it is ever sold. Date-suckers of special varieties have been ordered from Egypt and will be labelled and carefully planted in the best soil to act as parent palms for distribution to local cultivators.

Formation.—The Lahej Delta has been formed by deposits of alluvial soil brought down from the hinterland mountains, by the floods of the Tiban Wady after heavy rain. As the soil was gradually built up, the sea receded. Thus the soil nearest the sea has the least alluvial deposits and the greatest amount of salt and sand.

The country around Lahej, some twenty miles from the sea, is extremely fertile; the fertility of the soil gradually decreasing seawards, till at Shaikh Othman, three miles from the sea, only certain portions are worth cultivating where sufficient depth of soil and sweet water can be found in conjunction. Numerous sea shells are found scattered about and, at the depth of six feet or so, deposits of rough gravel and stones.

The soil is either a mixture of alluvial clay and salt sand, or pure clay and sand in distinct patches adjoining one another.

In fact the Lahej Delta very much resembles that of Egypt and no doubt, provided a sufficient storage of water could be artificially made in the hills to warrant canalisation, or wells bored yielding a big flow of water with pumps, large tracts could easily be reclaimed by steam-levelling, washing and draining the soil. The land would then become valuable for the growing of dates, cotton, sugarcane, grain, and citrus and other fruits, on a large commercial scale, exactly as is done in Egypt.

Soil and Water Supply.—The water supply is obtained from six stone lined wells. Three contain water which is slightly brackish; the remainder contain a much higher percentage of salt. The former undoubtedly tap the beds of underground streams draining under the Delta from the hills to the sea. There are two main *wadies* branching from the Tiban Wady above Lahej-El Kabir Wady on the West, and Es Saghir on the East sides of the Delta. These only fill and overflow when the Tiban is in flood.

But the underground streams do not appear to bear any relation to these *wadies* as they appear to meander about all over the Delta, thus considerably adding to the difficulty of following their course, in order to rely on striking sweet water.

Those wells yielding only salt water, I think can only be tapping the infiltration through the salt-soil of these main underground streams.

Each well is provided with a pump worked by air-motor and by a camel drawing up the water. The air-motors are capable of doing good work, but being dependent on the wind, three or four days of consecutive calm would leave the garden waterless, and young plants exposed to the strong sun require water every second day. Again it is in the cool of the early morning and in the evening that the watering of plants is most beneficial and it is just these periods when the wind is insufficient to work the motors. Neither is there generally sufficient wind during the night to fill the reservoirs.

So in addition, each well has the local appliance of a large, leathern bucket, whereby with an ingenious leathern spout and arrangement of ropes attached, over a wheel, to the back of the camel, a good supply of water is raised. But this method, though excellent in its way, is troublesome, antiquated and by no means inexpensive when the cost of camels, their drivers and attendants and their food, is taken into consideration.

When all six air-motors in addition to the camels are at work the water they yield is hardly sufficient if the whole of the garden were under vegetable cultivation at one time.

It will thus be seen that some other method would be more advantageous.

It has been found in the adjoining Settlement Garden that, when the well yielding the best water was deepened, a flow of water was obtained sufficient to keep an oil-engine working and a supply of sweet water adequate for the whole garden. By the distribution of this sweet water the whole soil here has been greatly improved and is undoubtedly in a finer state of fertility than the S. and T. Gardens, half of which has been watered from the salt wells.

It is therefore proposed to erect an oil-engine and pump on No. 3 well, which yields the sweetest water and should prove capable of supplying sweet water to the whole garden.

Three of the wells are in a line along the eastern wall and three along the western. Beginning at the south eastern corner we have—

Well No. 1—A shallow well of salt water and having no reservoir The soil round this well is very sandy and is suitable for cucumbers, melons and dates.

Well No. 2—Of fair depth, containing good water and a stone-built reservoir.

The soil round this well is undoubtedly the best in the garden and on it grow a variety of large trees both local and imported. It is a stiff, alluvial clay containing a little salt and requires to be well worked with manure, humus and sand before it can be brought into a first class condition. Tomato, beet-root, carrots, turnip, cluster and runner beans, egg-plant, and knol-khol, are all growing well and show good promise. Cabbage, cauliflower, and lettuce, have been tried, but at this low elevation no result of much worth can be expected.

Banana suckers have been obtained locally and planted in this sheltered and shaded spot. Shelter and shade are important factors in successful banana cultivation. Other varieties of bananas have been ordered from India.

Seeds of papaya have also been obtained as this fruit should also grow here.

Citrus, mango and other fruit trees have been ordered from India for planting in this part of the garden.

Well No. 3.—Contains the sweetest water and of good renewal, and has a large cement reservoir. Suitable for the proposed oil-engine as it stands on the highest level.

The soil here is partly in good condition and partly poor. In the former carrot, runner beans, beet-root, *palak* (spinack and other leaf vegetables, *okra* (lady's finger) and Indian radish do very well.

Well No. 4.—A shallow well of poor supply but fairly sweet water. Soil fairly good and producing same vegetables, less well grown than No. 3.

Well No. 5.—A deep well of good supply but the water is very salt. It has a large cement reservoir.

The western portion of the soil has not been cultivated for years and bears no trees or shade of any sort. The soil is very salt becoming sodden when watered and very hard and cracked when dry. The constant application of salt water must have deteriorated the soil considerably. It was unfortunate that this was the only well in working order when work was commenced and consequently this portion was selected to start work on. The seeds of all varieties of vegetables entirely failed and when the soil was redug and manured and sown with the local *baghi* or *kulfa* (an Indian leaf vegetable resembling a coarse spinach) which usually will grow in the poorest soil under any condition and at all seasons even this proved almost a complete failure. This was a somewhat discouraging start. But with cultivation and washing with sweet water, no doubt this soil can be brought back into fertility.

The eastern portion bears a few thorn trees and is good for local vegetables. *Baghi*, Indian radish, beet-root, and *okra*.

Well No. 6.—A salt and shallow well with no reservoir, the soil is mostly treeless, sandy and too high for the present water supply and only fit for local vegetables.

The variability of the soil in every square yard of the garden is remarkable, many squares growing one half of fine, healthy plants and in the other only a few sickly ones. Another important point is, that if this soil is left for any length of time uncultivated and unwatered the salt of the sub-soil is drawn to the surface by capillary action and rendered unprofitable for vegetables until it has again been cultivated for several seasons. Thus the closing down of this garden for two years owing to military operations within its limits, besides obliterating all water-channels and banks, caused great damage to the conditions of the soil.

It will thus be seen that the amount of good fertile soil is extremely limited for the growing of European vegetables at present, but that with an oil-engine, unlimited sweet water, and good and constant cultivation much of the remainder can be greatly improved and rendered profitable.

Shade.—The matter of shade and protection for the garden is one for consideration. At present the garden is bounded by a mud-brick wall considerably breached. This will serve somewhat to keep out the drifting salt blown up by the summer dust-storms. At present, owing to pressure of work, it remains unrepaired and the garden remains unprotected from dust, stray animals and thieves. It is hoped it will be completely repaired and the gates put in order before very long.

Where the soil is fertile and deep, a variety of trees grow and it is strikingly exemplified that under their shade the more delicate vegetables thrive best such as turnip, carrot, and cabbage. But though the lower limbs of these have all been lopped leaving only the higher branches to admit light and air, these big trees still remain unsuitable.

Therefore some more suitable shade is required to protect the plants from the direct rays of the strong sun and from the hot salt of the dust storms, which prove quite fatal to unprotected seedlings and transplants.

The most suitable tree would probably be the *Sesbania grandiflora*, of which both the *alba* and *rosa* are to be found growing freely in the garden, where they were probably originally planted as ornamental trees. It forms an ideal shade, for, besides being small and of rapid growth, it benefits the soil with its nitrogenous root nodules and leaves. As soon as seed has been collected, it is proposed to plant this tree in rows throughout all the treeless portions of the garden.

Manure.—Only fresh camel and mule-manure is obtainable locally in any quantity, as no manure is allowed to be kept on account of flies. In consequence it is of very little value, save as an agent for breaking up the stiff soil. Kept for several months in pit, and occasionally watered, it will rot and then become of value. This is now being done and the pits so filled will be ready, on the spot for next September.

A limited amount of cattle and sheep manure is obtainable and this is likewise stored in pits.

A large quantity of ash is available from the incinerators, after the burning of night-soil, animal-manure, and rubbish. This should be rich in potash and other valuable salts, but its chemical action in conjunction with this salt soil is unknown, nor are the proper quantities to apply. So it has only been used sparingly with the animal manure sweepings.

So it cannot be said that the soil has been properly manured this season. Samples of this ash have been sent to India and Ceylon for report and advice.

Season.—The winter season commences in October and ceases in March. It is only during the colder temperature, moderately free from the destructive salt dust-storms and excessive heat, that any vegetables other than the local ones will grow.

In September all land should be dug up and left to air and sun for a week before being prepared and ridged ready for sowing early in October.

The summer season commences in April and lasts till September and during this hot and dusty season, the only vegetables that will thrive are the Indian leaf vegetables, *mat* locally called *baghi* and *kulfa* or *rijna*. Both these grow with the greatest ease, being sown broadcast in the squares well prepared with manure and soil in a fine tilth. They mature in twenty five to thirty days and will bear two to three cuttings before being left for seed. Easy of cultivation and requiring no attention beyond watering and cutting, and being free from pests during the hot weather, and yielding a heavy crop, it will be seen they are extremely profitable to grow as well as health giving. Unfortunately though much appreciated by native troops, they are not very palatable for Europeans.

It is probably possible to grow a few other vegetables, such as Indian radish, under shade but the results are said to be very poor.

Water-melons and a course cucumber will also grow during the summer but beyond these, nothing.

Naturally the continual watering and cultivation of the soil keeps it in good condition for the winter crop.

Cultivation.—The land should be prepared by first scraping and removing the salt soil collected on the surface.

Alternate banks and water channels are then lined out 10–12 feet apart and the banks roughly made up. Then the cross banks at the same distance. Water should then be let in and when sufficiently dry but still soft, the soil dug up deeply, levelled, and the banks straightened and strengthened.

It has apparently been the custom to sow broadcast or to transplant, on the flat surface of the small squares into which the land is divided by banks for irrigation from the water channels. But my experience has been that this method caused much of the seed to be swept to one side by the in-rush of water ; that the more delicate seeds found difficulty in making their way through the sodden, heavy soil when watered, or the hard cracked surface when dry ; and that the seedlings were apt to be drowned with the excess of water not always easy to control.

The effect of ridging was tried for all vegetables. This proved undoubtedly beneficial, as seeds which, sown on the flat completely failed, when sown on ridges in the same plot, grew well.

These ridges should be made after each square is perfectly level. Otherwise the water overflows and breaks the ridges on the low sides before reaching the higher. The manure should then be evenly spread, lightly scraped into ridges and then the intermediate soil brought on top, thus ensuring the greatest benefit from the manure beneath, to the plant sown half way up the ridge.

These ridges should be of substantial size, as if too small they soon subside with watering and render cultivation between them more difficult.

Ridging serves to prevent the washing away of the seeds; to prevent the soil becoming sodden or cracked, and to shade and protect the young plants to a certain degree. It is considerably a more expensive and troublesome form of cultivation; but for vegetables under irrigation the results are decidedly justifiable. The larger vegetables should be sown on one side of the ridges only, the smaller on both.

It will be found that the salt rises to the top of these ridges in a peculiar fine powder. This should be removed before the ridges are made up again, when the plants are sufficiently grown. All vacancies can then be resown and manure dug lightly in between the ridges to benefit the roots. It will be found that the plants make a sudden, rapid growth after this treatment, as at first they show remarkably slow growth after germination, due no doubt to the salt on the surface.

Seeds.—In my opinion, Indian acclimatised seeds from Poona or Bangalore give a better result than those from England, which often fail to even germinate under this strong continuous sun.

Secondly, the elevation is far too low for anything save the hardier varieties. Marrow, broad-beans, scarlet lettuce, runners, cabbage, cauliflower, brussels sprouts, peas etc, will never repay the trouble for growing them, even if they germinate. It is also important that the seeds be perfectly fresh.

With the assistance and advice of the agricultural authorities in Poona, a variety of vegetable seeds likely to suit this climate were selected. Some have failed notably the big-bean cow-pea which generally is most easily grown in low elevations and a dry climate and produces an abundance of beans ; but some have done remarkably well such as beet-root and *palak* both of which are specially suited to salt soils.

Local seeds *Baghi* (*chenopodium album*) *Rijna*, and Radish are generally obtainable in plenty, but now are very scarce and double the price. Thus not very much of this has been sown, especially as in November and December, it is so attacked by a pest as to be hardly worth sowing. Seed then from these crops should be gathered in August before the land is finally dug up and prepared for the winter crops.

The seeds should be stored in *sealed tins* till required for sowing again in March.

Transplanting.—It is doubtful whether the transplanting of plants from a nursery repays the time and trouble unless great care is exercised in the matter of planting, watering and shading. Otherwise the percentage of loss is very great owing to the strong sun, salt soil, and dust-storms.

Tomatoes may perhaps be sown in raised nurseries carefully prepared and shaded in September, to be ready for planting out in October. They should only be transplanted when of fairly large size and of vigorous growth.

Otherwise it is preferable to sow direct in the ridges such plants as, egg-plant (bringal) knol-khol, beet-root etc. and thin out, transplanting from these any vacancies that may occur.

Labour.—Labour is fairly good and easy to *obtain*. But the Arab is not essentially a born gardener in the sense that a Chinaman is. Certain crops of grain, fruit and vegetables that do not require much cultivation or attention he can grow. His chief ambition and idea is to sow the seed and leave the rest to providence. Of modern methods or new varieties of produce he knows nothing and cares less.

In consequence all the labour now employed some fifty men and boys have had to be personally trained and as they are remarkably stupid and at the same time very independent, the task has been no easy one.

Only about ten per cent show any signs at present of ever proving satisfactory in the way of the regular attendance, hard work and intelligence appertaining to a garden.

Before the war, wages for men were Rs. 10-12 per month, now they have risen to Rs. 15-18, owing to the increased demand and the high prices of all food stuffs.

Weeds.—The garden is absolutely free from weeds, save needle-grass which has spread over the whole garden from the plots where it was originally planted. This grass is exceedingly difficult to uproot and eradicate, and it is very harmful to other plants.

Pests.—The most destructive pest found as yet is a small, grey brown moth which produces a small green caterpillar. This appears in November and December and completely destroys the *Baghi.* Some years it is apparently worse than others and this year it has destroyed all in both gardens.

No *baghi* should then be allowed during these months, as harbouring, and increasing the pest it soon spreads to other vegetable such as *palak* (spinach) beetroot, carrots, knolkhol etc, to which it causes serious damage. When these are attacked the larger leaves should be cut off and the plants sprinkled with a mixture of sulphur and ash, or lime and Paris-green in the proportion of 10 to 1.

Wag-tails, sun-birds, larks and other insectiverous birds haunting the gardens, should be protected, as they help in keeping this pest in check.

Locusts appear from the desert at certain periods and cause great damage. Though white-ants are present, they do not seem to do much harm.

Conclusions.—As has been shown the garden will only produce a limited amount of certain European vegetables during the cold weather and a larger amount of local leaf-vegetables during the summer. This cannot possibly be expected to provide for the population, military and civil of Aden and Shaikh Othman at the present time, as nearly 3000 lbs. of green vegetable food per day is required. Under existing circumstances the garden could only produce 600-700 lbs. per diem, doing its very best, for any length of period.

To provide for such in sufficient and cheap quantities the assistance of outside and local cultivators is required, which under the present soil and water conditions is out of the question round Shaikh Othman.

The most obvious way would be the establishment of Lahej of a permanent Government garden for the demonstration to local cultivators of improved methods of vegetable fruit gardening and for the free distribution of seeds and plants of new and suitable varieties.

But even here in the summer, very few European vegetables can be profitably grown, nearly all succumbing to the heat and dust-storms. Therefore a second Government garden on like lines should be established at a much higher elevation in the hinterland for the summer supply.

By these means only can Aden be rendered independent for her supplies of fresh fruit, fodder and vegetables which hitherto have largely had to be imported at great cost from other countries.

But as the hinterland is at present in enemy hands other sources of supply for the summer 1917 must be sought on the Somaliland Coast.

-:o:-

SECOND REPORT (April 1917).

About sixteen acres are now under cultivation, the remaining eleven of the twenty-seven acres consisting of eight acres of previously uncultivated land (high and unlevelled), two of very salt soil, and one of roads, wells etc.

By using the camels on the wells for eight hours per day and for seven days in the week, as well as the air-motor pumps, each of the six wells can only keep three acres each properly watered.

Much of the labour has been expended on banking, canalising, and preparing new land in preparation for the summer crop of *baghi*, levelling and canalising three acres never before cultivated, and constructing high-level channels to conduct the water from No. 3 well all over the garden, in preparation for the oil-engine pump. In the low places the canal has had to be raised as much as three feet and has been personally traced and pegged out by eye, as no one could be spared to take the levels properly. The silted sand has been cleared away from outside the walls with the help of fatigue parties. The wells have been deepened and other works have been carried out entailing a heavy expense out of proportion to the produce.

But in spite of this the results are so satisfactory as to warrant the outlay for a large and profitable output of vegetables and fruit for next cold weather.

Soil.—Samples of soil taken down the sides of holes three feet deep from land watered by wells Nos. 2, 4 and 5 were sent to Dr. Mann, Principal of the Poona Agricultural College, who very kindly analysed them with the following interesting results :—

	No. 1 soil from No. 2 well	No. 2 soil from No. 4 well	No. 3 soil from No. 5 well.
	%	%	%
Finest Silt and clay	14·38	8·47	9·86
Fine silt	9·92	1·59	1·53
Medium Silt	10·84	3·25	1·54
Coarse silt	24·80	10·82	3·08
Fine sand	31·73	48·61	46·83
Coarse sand	8·33	27·26	37·16
Loss on Ignition	13·94	6·04	7·22
Sand	60·58	75·26	74·00
Lime	4·36	3·36	3·92
Nitrogen	0·09	0·04	0·04
Potash	0·54	0·37	0·46
Phosphoric acid	0·22	0·08	0·11
Total Soluble Salts	0·840	0·310	1·150
Containing :—			
Calcium Carbonate	0·034	0·050	0·038
Calcium sulphate	0·074	...	0·044
Magnesium sulphate	0·097	0·034	0·032
Magnesium carbonate	...	0·014	...
Sodium sulphate	0·152	0·069	0·216
Sodium chloride	0·452	0·115	0·693

Dr. Mann reported as follows:—

"As in most soils in such arid places the nitrogen is exceedingly deficient, the phosphoric acid, potash and lime, in abundance. The soil from No. 2 well seems to be a pretty heavy clayey material. The other two would appear to be much more coarse in texture. The peculiar point about these soils, however, is the very excessive amount of salt which they contain, chiefly sodium chloride, as you will see from the analyses, and it is evident that they will require enormous quantities of water and manure if this salt is not to be fatal to your cultivation."

And in a second letter in reply to a question as to what he thought the best treatment.

"The soil lacks organic matter. Anything green, especially leguminous crops, grown and dug in will be very beneficial and then add oil-cake (castor best) as an artificial nitrogenous manure."

At the same time I sent a sample of the ash from the incinerators of camel, mule dung, night soil and other rubbish. Dr. Mann's analyses gave the following figures :

Nitrogen.	—	. 23 percent
Potash.	—	. 93 percent
Phosphoric acid.	—	. 85 percent

He reported that "the analysis of the incinerated camel and mule dung &c. is not very promising, but it contains enough potash and phosphoric acid to make it worth applying if you have not to carry it any distance."

It is unfortunate that the ash should prove so rich in potash and poor in nitrogen when the soil has already plenty of potash and lacks nitrogen.

Water.—Water has given great trouble, inasmuch as sick camels, the necessity of constantly repairing the leathern well-buckets, and series of windless days in February and March, caused serious shortage, especially when large acreages of young and delicate plants, like knol-khols, has been planted out. Trained camels for well-work are exceedingly difficult to obtain and none can be had for hire, and on one occasion two well-camels went sick with colic at the same time, causing great trouble. When the oil-engine, which has arrived in Aden from Bombay, is in working order these troubles should cease. But it is by no means certain as yet if No. 3 well is going to yield the requisite amount of water when it has been deepened, which will be done as soon as the pump is erected and can keep the well dry. This work is well in hand and the pump should be working sometime in April. It is a six horse-power, Blackstone Engine, capable of pumping 185 gallons per minute. The pump is a 3" Gwynne's "Inv", Centrifugal pump.

Produce.—The following is the result of the vegetables, many of which were only tried for experimental purposes.

1. Earliest and most profitable winter vegetables for troops.

Indian Radish.—Sown along small ridges yields a splendid crop in even poor soil in from five to six weeks from sowing. If not allowed to get too old, both the roots and the leaves for spinach are acceptable to British as well as native troops. It should not be sown after February and should be sown in September ready for October consumption.

Knolkhol.—(*Brassica oleracea*) grows easily and is a prolific yielder. The globes weigh over a pound each, and are much appreciated by British troops, whilst the leaves are utilised by native troops for soups and curries. Seeds must be sown in nurseries in October and November and transplanted out when a month old in well-manured squares on the flat and kept watered every other day till they have become established. Dead plants should be immediately replaced with new ones. Sandy soil, lightly shaded, suits them best. They should be ready for pulling in ten to twelve weeks from sowing. Plants not transplanted will not form globes and make poor growth. It is no use planting out after the middle of February, as the first hot weather checks their growth.

Beetroot.—Fine roots of 1-2 lbs. each have been obtained and the crop grows well. It does best sown on ridges in December and thinned out. It can be transplanted, but a large percentage die. Earlier planting runs the risk of being entirely destroyed by the *baghi* pest, which also attacks its relative *palak* ; if sown in October, the tubers mature in three months.

Palak.—(*Amaranthus mangostanus*). A species of green leaved beet, which makes an excellent spinach appreciated by British troops. It is quick-growing and prolific. Leaf-picking begins four weeks after sowing on ridges and continues for two months when the plants commence to bear seeds, which should be collected. There are a large number of these Indian spinachs and care should be taken to obtain the right variety, which has a seed resembling that of beetroot. An Indian firm sent us 10 lbs. of another variety, charging an exorbitant price which gave a slow and very bad germination of an inferior vegetable.

Baghi.—(Goose-foot, *Chenopodium album*) gives a large yearly crop of a leaf vegetable resembling a coarse spinach. Matures in forty days and can be cut three times before seeding. Large quantities of seed are required as it is sown broad-cast rather thickly. It must not be sown between September and January as it is attacked by a pest that completely destroys it. There are several varieties of this plant.

These five vegetables then, give the best returns.

2. *Second best vegetables.*

Tomatoes.—Those that were earliest transplanted under the light shade of No. 2 Well in what appeared :to be the best soil in the garden gave very poor results due to too much shade and too heavy soil. They were trained on trellis and sticks and well pruned and manured. Those that gave a better crop were planted out in the sandy soil of No. 1 Well and grown without any shade, and were trained on sticks to one stem only

The "*Extra Early*" and "*Large Red*" gave poor results, but *King Humbert* a small, delicate, plum-shaped tomato was very prolific. Sown in nurseries in October the plants may be transplanted out up to the end of January.

The earlier fruits suffered from a fungus disease attacking the end of the fruit which either arrested the growth or completely rotted the fruit. Quite half of the crops were lost in this way. Spraying with Bordeaux mixture (copper blue-stone) might be tried, but the fruits would have to be washed when gathered.

Carrots.—Sown on ridges and thinned out to one plant these do fairly well in sandy soil though they do not make big roots and take three months to mature.

Turnips.—The same applies to these as to carrots save that the tops can be used as spinachs. After rain a mould attacked the leaves and caused them to check their growth and that of the root. Avoid shade and sow wide.

Cluster Bean.—Fairly prolific and tender, sweet beans ready for picking in six to eight weeks of sowing. They require good soil as they show, in a striking way, the lack of nitrogen in the soil by their yellow leaves and stunted growth.

Cabbage.—This certainly grows, but requires to be sown in October and planted out early in November as it only makes good growth during the coldest weather. The plants should be tied up to encourage growth of heart, otherwise the hearts are very small. They make good green stuff for native troops even with little or no heart.

Lettuce.—Grown under light shade in good soil, these will give fairly good plants.

English radish.—Grows easily and well and can be pulled in four to five weeks after sowing.

Okhra.—Or ladies' finger, only grows and yields well in the best soil otherwise the shrubs are small and the fruits meagre. This vegetable is not very acceptable to the British troops.

Egg-plants (*brinjal*).—This also requires good soil when it produces large fruit. But it is of slow growth and small yield. The plants will stand for as long as two years if watered. They are subject to be attacked by the 'woolly aphis' which was found where this plant grew under too dense a shade. The same pest was also found on neighbouring *tulip* trees.

Chillies.—Grow exceedingly well and yield a very large crop even in poor soil next that which failed to produce *Okhra.* But as these are imported in the dried state there is little demand for them.

3. *Vegetables of little or no use.*

Ambadi (*Hibiscus cannabinus*) *and safflower*—Both these leaf vegetables grow very quickly and well in poor soil, but are not acceptable to Indian troops other than Marathas.

Runner Beans.—Several varieties of both these and cow-peas were tried but only two runner beans were successful. Though prolific in bearing, the young pods are too tough, when served as French beans, for European taste and are too slow of growth and troublesome to pick for use of native troops. They would be useful only as a dried haricot-bean which can be imported.

Cauliflower.—These grew well when planted out but made no heart. The stalks and leaves are, however, acceptable to native troops.

Cucumber.—Those of European varieties that were sown grew well but would not fruit proving a complete failure. The local inferior variety should do well.

Celery.—Only grows small and green, and can only be used for garnishing.

Fennel.—Grows prolifically, and the seeds are of local value.

Pumpkins—Grow fairly well but are very slow and take up too much space in a garden. These are best grown amongst some standing crops, such as millet or maize.

4. *Vegetables which might be tried.*

Asparagus.—There are a few plants of this in the garden and undoubtedly if a little trouble were taken it would be as well as it does in Egypt in the winter.

Maize.—The American sugar-maize should do as well in the green cob-stage.

Sweet Potatoes.—Local varieties of these might be tried. It is said English potatoes have been grown in small quantities and also mushrooms.

Jerusalem Artichokes.—Will undoubtedly thrive.

Fruits.—The date palms commenced flowering at the end of February and finished at the end of March. There are fifty female palms in bearing and all were fertilised by hand. Some of the palms appear to be bearing a remarkably good crop, though no special manure or cultivation has been given them. Unfortunately, whoever planted out these palms originally, evidently did it more for effect than use, having taken random seedlings instead of female suckers, so that there is an unnecessary large proportion of males. The greater part are *Medina*, a yellow date, and *Sakkoti*, a red date, and are from 25 years old downwards. There are also several inferior dates such as *Sheree*, a small black date and *Zabeede*, a long yellow one.

There only appear to be two survivors of those imported from Busra near wells 1 and 6, which have distinctive red bark but have not yet flowered. Fifteen female suckers taken from palms in the garden have been placed in well prepared holes. March appears to be the best season for planting. Twenty-six suckers from selected varieties have been received in April from the Ministry of Agriculture of Egypt namely 4 *Hanvani*, 7 *Arbai*, 5 *Amri*, 7 *Amhat* and 3 *Males*. These will be planted in the sandy soil bordering the new high-level canal flowing westwards from No. 3 well. The holes have been well manured with beanvines and mule manure. They have been planted in the following order counting from No. 4 well : 7 *Amhat* 1 Male 4 *Havani* 1 Male 5 *Amri* 1 Male 7 *Arabi* 2 *Unnamed*.

Bananas.—Several suckers have been procured from Lahej and planted upright, but have made poor growth. The following varieties of suckers have been received from the Poona Agricultural Department and arrived in excellent condition. *Pasrai*, *Rajeli*, *Lal welchi*, and *Sonkel*. The West Indian method was adopted which greatly facilitated the packing and transport, namely, the stem was cut off six inches above the root which were selected as having good eyes. These were laid, eye-uppermost, in well prepared holes a foot from the surface and completely buried. In one month they sprouted and are now fine healthy plants.

Mangoes.—These and the citrus came from the Poona Agricultural Department and also arrived in good condition. Of the four *Pairi* and two *Alphonse*, grafted trees, only one *Pairi* has died.

Oranges.—4 *Musambi* and 2 *Santra* all have survived.

Limes.—Of the six limes only one has survived. They were maller trees and presumably more delicate.

Papaya.—The seeds received from India all failed to germinate, but these seeds are extremely difficult to send long distances in good condition. Seeds from fresh fruits of the inferior local varieties have been sown.

Melons.—Seed was obtained from Lahej of mixed varieties. These grow quickly and well though both vines and fruit were attacked by both the larvae and adult of the red-melon-beetle. Spraying with an insecticide such as *Khatterkiller*, will be tried. The seeds appear to have been originally imported from Egypt and Europe; for some resembled the smooth yellow *shumum* of Egypt and others the netted and quartered French varieties. The seeds of those with the best flavour and flesh have been carefully selected for re-sowing as melons do grow well during the summer. The sandy portions of wells Nos. 1 and 3 suit them best, if sown in holes with plenty of well-rotted manure. Care should be taken to gather the fruit whilst still green, but mature, and ripen in the shade, otherwise the heat of the day followed by the cold nights causes the melons to split in pieces. Seeds were received from Egypt of the best variety of Melon but though they grow well the fruit failed to mature. The season may have influenced this and they will be tried again in the summer.

Pineapples.—Might perhaps succeed and suckers will be obtained from India.

Other Products: Cotton.—A good deal of self sown cotton comes up in the garden both of the local variety and an imported one. The former is valueless, having a strong but very short staple, but the latter seems of likely appearance and bears good crops. Both have been sent to Egypt for report, as well as a sample, brought back from Somaliland on which it is reported "This cotton (Caravonica?) is not at all bad as regards length and strength of fibre, but it lacks fineness. The seed is the biggest I have seen and completely devoid. Although the seed is large, the ginning outturn is good." A favourable report—the seed should be of great value for oil, cake, or animal food.

Barley.—From seeds in the manure, quite a lot of this has sprung up in the garden and appears to grow exceedingly well in a short period and to bear fine heads—as many as twenty five to a single root. The plants only grow about a foot and a half high, but were not allowed to ripen.

Clover and Lucerne.—Both these grow in the garden but the latter should stand for two or three years, though it is doubtful if it would survive the dust-storms. However the valuable Egyptian berseem might well be tried next cold weather; for besides being quick-growing and yielding three cuttings of valuable animal fodder, it is of the greatest value to the soil, ploughed or dug in green at the end of the season, especially to this soil which lacks nitrogen.

Sorghum and Millet.—Require good soil and plenty of manure to grow well. The former is attacked by the stem-borer.

Manure.—Two large pits under No. 1 and 2 Wells have been filled with cattle manure and the blood (rich in nitrogen) from the slaughter house is daily poured over it, so we should have an exceedingly rich store for the winter vegetables. Other pits have been filled with camel and mule manure.

An experiment with knolkhols grown in eight squares each ten feet square with different mixtures of manure and ash showed that the addition of ash made little or no difference (vide Dr. Mann's analysis). Four baskets of old manure weighing fifty pounds gave the finest result in large knolkhols and plentiful leaf. No manure plot though the soil (very sandy) was virgin, gave very poor results. There did not appear to be much difference between old and new manure applied in the same quantities.

Shade.—With the constant application of water and manure the shade of existing trees becomes so dense that vegetables beneath suffered. All trees have been severely lopped of all lower branches leaving only a little high top shade and many useless or crowded trees cut down.

Distribution.—An avenue of some sixty acacia, tulip (*Lirisden dron*), neem (*Melia Indica*), and other trees has been established in the brigade headquarters compound. The soil was very salty and the water brackish and many of the first trees planted died. But with the washing of the soil and gradually replanting those that died, all trees are now established and growing well, protected from sun, dust and animals by wooden cages interlaced with palm leaves.

Tulip trees which appear to be the easiest to establish and are quick-growing and green, have also been established round the new well at Kobat.

Other trees and seeds have been distributed to Khor Muksah and Aden respectively, the Aden tank gardens, and various private house-holders in Aden,

Pests.—The small, green caterpillar pest on the *baghi* continued till the end of December and also destroyed much of the beetroot and *palak*. Dusting with ash and sulphur was unsuccessfully tried. When the plants are young, filling up the squares and brushing the plants seems the best way thereby drowning them. This pest will also attack Indian radish and knolkhol leaves in a lesser degree. Undoubtedly this is the most serious pest to contend with and no *baghi* should be sown after August and none remain in October to give the pest a breeding ground. This should be enforced by law if necessary amongst all local growers of vegetables.

Labour.—This has been good and the Arabs fairly settled down to the work when firmly handled, but unless constantly driven and supervised they will never be, I fear, anything but ignorant and lazy.

It is most necessary that a few head gardeners be introduced –men who really understand the technique of raising good vegetables. Letters have been written to the Directors of the Agricultural Department of the Malay States and Burmah to assist in finding Chinese, who are the best gardeners in the world for this sort of work. Failing this, Egypt will be applied to, because it is very important that good head gardeners are established before next winter, if a large crop of many varieties of vegetables is to be expected. They will also be valuable in teaching new and better methods to local growers.

(Supplement.)

An Ecological Study of the Secondary Formations in the Rice Fields at Alibag.

BY

M. Ezekiel, B. A., M. Sc.

IN the course of his wanderings in search of plants in the heavy rainfall tract of the Kolaba District, nothing struck the writer more than the enormous number of plants thriving in rice fields, before and after the harvesting of the crops. The thick vegetal covering of the broad bunds of rice fields, before the harvesting of the crop, and the close covering of the fields themselves after harvesting of the crops attracted his attention. A superficial survey of these plants, growing in rice fields between Alibag and Revdanda, made in October 1915, was enough to convince the writer of the extremely interesting nature of the phenomenon, exhibited by this set of plants. A taxonomic survey of these plants was therefore made in October and December 1916 and February 1917. There had been an unusually heavy fall of rain in October 1916, and many of the hydrophytic and mesophytic forms were still in flower. These were collected and short ecological notes made on the fields. Short notes on the root and shoot-habits were also made. These were subsequently supplemented and amplified in the months of September and October 1917.

After a comparatively superficial study of these plants, it was found that they may be classed in two distinct groups, The first group consists of hydrophytic and mesophytic forms flowering from August to December, and the second group less mesophytic and more xerophytic, flowering from December to April. The subsequent closer study of the shoot and root-habits of these two groups of plants, and an observational study of their water-relations, made in the months of February 1916 and September 1917, served only to confirm the belief.

In order to make a physiognomic and physiological study of the vegetation of a limited area, it is important to make a short study of the climate of the district. The following notes on climate of Alibag are taken from the Bombay Gazetteer. "The year may be roughly divided into four seasons. The rains from June to October, the damp hot weather in October and November, the cold weather from December to March, and the dry hot weather from March to June. The rainfall averages about 80 inches, is lighter than in parts near the Sahyadris, the air at other times is damper, it is free from hot winds and has almost always some sea breeze.

In the end of May large masses of clouds begin to gather and pile over the Sahyadris. The Westerly breeze, that has been blowing for weeks, lulls and after one or two showers the rains burst, with heavy thunder-storms in the first fortnight of June. The South-West wind again freshens and blows more or less fiercely or fitfully according to the season, till the end of September. In ordinary years, during most of this time, the sky is covered with clouds, the bursts of rain and wind being fiercest in the latter part of June and throughout July. ...The air is cool and fresh, and from the damp sometimes feels almost cold. In the drier years the rain ceases for days, or even for a week or a fortnight, sometimes with pleasant strong breeze, but generally with some still steamy days, before the rain again sets in either a little before or a little after the beginning of October, the South-west wind drops and the rain ceases. Clouds continue to hang about and occasionally with a warm wind from the East, there are severe thunder-storms. The air is changed with electricity, the sea-breeze fails and the nights are close and oppressive. This is the unhealthiest part of the year. By the middle of November, as the nights lengthen, the mornings grow cool, and the land wind begins to blow before day-break and the sea-breeze in the afternoon. December, January and February are the cool months, generally with clear nights and heavy dews. Along the coast the Sun is seldom oppressive, and the nights though cool are not cold... During the whole of the cold weather there are occasionally cloudy days, with still warm nights."

Rainfall :—The maximum rainfall has reached the enormous total of 144 inches in 1878 and the minimum of 40 in 1871 and the average is 80 inches. The Alibag thermometer readings for the five years ending 1879 show that May is the hottest month with an extreme maximum of 95·2 and an extreme minimum of 80. January is the coldest month with an extreme maximum of 87, and an extreme minimum of 62·6. The mean daily thermometer range is greatest, 15·4 in January and least 3·4 in July.

The following is a list of weeds commonly found in rice fields.

FIRST GROUP.

Lythraceae	Ammania baccifera Linn.
Compositae	Ageratum conyzoides Linn.
,,	Caesulia axillaris Roxb.
Verbenaceae	Lippia nodiflora Rich.
Acanthaceae	Hygrophila spinosa T. Andrews.
Graminaceae	Panicum flavidum Retz.
,,	,, frumentaceum.
,,	Eleucine indica Gaertn.
,,	Diplachne fusca (in salt marshes).
Cyperaceae	Cyperus aristatus Roth.
,,	,, Iria Linn.
,,	,, difformis Linn.
,,	,, exaltatus Retz.
,,	Fimbristylis quinquangularis ?

SECOND GROUP.

Tiliaceae	Corchorus fascicularis Lamk.
Papaveraceae	Argemone mexicana Linn.
Leguminosae	Alysicarpus rugosus D. C.
Ficoidae	Mollugo hirta Thumb.
Gentianaceae	Canscora diffusa R. Br.
Rubiaceae	Oldenlandia corymbosa Linn.
,,	,, herbacea Roxb.
Compositae	Sphaeranthus indicus Linn.
,,	Spilanthes Acemella Linn.
,,	Gnaphalium indicum Linn.
,,	Xanthium strumarium Linn.
Convolvulaceae	Ipomoea reniformis Chois.
,,	Cressa cretica Linn (in salt marshes).
,,	Evolvulus alsinoides Linn.
Elatinaceae	Bergia ammanoides Benth.
Portulacaceae	Portulaca oleracea Linn.
Commelinaceae	Aneilima spiratum R. Br.
Solanaceae	Solanum xanthocarpum Schrad and Wendl.
Hydrophyllaceae	Hydroleae Zeylanica Vahl.

Acanthaceae	Hygrophila Serpyllum T. Andrews
,,	Rungia parviflorn Nees.
Chenopodiaceae	Chenopodium album Linn.
Onagraceae	Ludwigia parviflora Roxb.
Lythraceae	Ammania tenuis C. B. Clarke.
Scrophulariaceae	Stemodia viscosa Roxb.
,,	,, serrata Benth.
Boraginaceae	Heliotropium ovalifolium Forsk.
,,	,, supinum Linn.
Euphorbiaceae	Crozophora plicata A. Juse.
,,	Euphorbia Pilulifera Linn.
,,	,, thymifolia Burm.
,,	,, hypericifolia Linn.
,,	,, microphylla Heyne.
,,	,, coccinea Roth.
,,	,, zornioides Bois.
Amarantaceae	Amarantus Blitum Linn.
,,	,, spinosus Linn.
,,	,, polygamus Linn.
Eriocauleae	Eriocaulon.
Graminaceae	Arundinella agrostoides.
,,	Elytrophorus articulatus Beauv.

The following plants are also found in the rice fields and very often on the broad bunds. They belong to the first group.

Compositae	Eclipta alba Haesk.
Companulaceae	Sphenoclea zeylanica (in salt marshes).
Graminaceae	Eriocloa polystachya H. B. and K. (in salt marshes).
,,	Isachne australis.
,,	Coix Lachryma Jobii Linn.
,,	Eragrostis amabilis.
,,	Ischœmum aristatum Subspecies barbatus.
,,	Andropogon Odoratus.
,,	Anthisteria Ciliata.
Leguminosae	Geisopsis cristata (on bunds only).
Gentianaceae	Exacum pumilum Grieab.
Amarantaceae	Celosia argentea Linn.

The first group of plants germinate at the commencement of the rains, and begin to flower in the middle of August, and continue to do so right to the end of October. Most of these are aquatic or semi-aquatic plants. In years when the rains of October and November are effectively heavy and well distributed, some of the more resistant of these such as Ammania baccifera, Hygrophila spinosa, Hydrolea zeylanica, Eclipta alba, Ludwigia parviflora, are found to be in flower right to the end of December. This is particularly marked in fields more favourably situated as regards water-supply.

The seeds of the second group of plants remain dormant until the cessation of the rains in October. They germinate when the layer of water on the soil has practically disappeared. There is, however, sufficient moisture in the soil for the germination and vigorous growth of the plants. The water however, rapidly dries up, and the seedlings adapt themselves to the new conditions, by the formation of a deep woody tap-root, and thus derive their supply of water from the deeper layers of the soil. The growth of the root is many times that of the shoot, and the plants are thus able to cope with increasing demand on their supply of water, due to the physical condition of the soil and the dry weather.

Root Habits :—While carrying on a study of the Secondary Formations of rice fields of the Alibag Taluka in November and December 1916 and January and February 1917, it soon became apparent, that for a proper understanding of the development and structure of these Formations, a knowledge of the root systems of the more important and constant species was imperative. Consequently 500 root-systems of 50 species of plants were examined. The following portion of the paper deals with a study of these systems, with their descriptions and a discussion of the conditions under which the plants grow.

FIRST GROUP.

The plants of the first group are mostly aquatic or semi-aquatic and possess the following characteristics of their root-systems.

They possess in most cases two types of roots.

(1) Fibrous, much branched and superficial, growing in a direction parallel to the surface of the soil.

(2) Herbaceous, little branched, thick and deep.

This is true of :—

Scirpus articulatus.
Caesulia axillaris.
Finbristylis quinquangularis.
Panicum frumentaceum.
Panicum fluitans.
Ammania baccifera.
Cyperus Iria.
C. corymbosus.

Only the superficial aerating roots are branched, the rest have few branches and do not reach a great depth. The roots of most of these, and to a greater extent the roots of—

Isachne australis.
Eclipta alba.
Alysicarpus rugosus.
Sphenochlia zeylanica.
Cyperus difformis.

show a differentiation into three kinds :

(1) Fibrous, much branched, superficial arising from the stem above the level of the soil, spreading along the surface and profusely branching. These are thin and fibrous. They may be called aerating roots.

(2) Deep, herbaceous, little branched, serving chiefly as absorbing organs.

(3) Stiff and woody, reaching a great depth, and possessing but few branches. They serve as anchoring organs and little more in the wet season, but in the time of need and in the drier years they may function as organs of absorption.

That the anchoring roots do little absorption is evident from the entire absence of tubercles on these in the Leguminous species.—Alysicarpus rugosus. The aerating roots are very prominent in—

Sphenoclea zeylanica.
Eriocloa polystachia.

while

Cyperus difformis.
Diplachne fusca.

show only a slight development of aerating roots and there is little differentiation in the rest. Hygrophila spinosa persists in rice fields with remarkable resistivity. An examination of its root system shows that the anchoring roots serve also as absorbing organs in the dry season.

The area of the fields from which the plants were studied, extends from Mula, a village two miles North of Alibag, to the most Southern corner of Revdanda, about ten miles from Alibag. All the rice fields adjacent to the road between Alibag and Revdanda were searched. For examining the plants growing in fields beyond the backwater creek at Nagaon, several fields in the villages beyond were also investigated.

Since the supply of water in this region, is the chief limiting factor to plant growth, it is thought advisable to first consider the total amount of precipitation with its monthly distribution, which latter is certainly of great importance. The average annual precipitation is about 80 inches and the maximum reached during the last fifteen years is 104 inches. This huge amount is chiefly distributed over not more than four months —rainfall for the rest of the period being negligible. Notwithstanding the fact that the precipitation is enormous, it must be recognised that rains mostly cease by the end of September, and the strong Westerly wind and the peculiar condition of the soil, make the retention of moisture in the surface-soil extremely difficult.

The period from October to February which is the chief season for growth and flowering of the second group of plants, is semi-arid, and relatively exacting for these annuals. Ecologists recognise that relative dryness of the air and soil during the growing season, favours the development of xerophytic forms. Also that the vegetation of a limited area is not only an expression of present conditions but to a greater extent, a record of conditions that have obtained during a long period of many years. Since this record is not likely to be altered greatly by a year or two in which conditions may depart from the normal, a study of the precipitation-table is instructive. The table gives the mean monthly precipitation for a period of many years, and may be considered as very representative of the conditions obtaining in the area studied.

It may be pointed out that nearly $\frac{19}{20}$ths of the precipitation occurs before the germination of the second group of plants. During this time the fields are practically submerged in water and the light showers of October and November are effective in supplying the additional moisture required for the growth of these plants, during the rest of the dry period.

It is not rainfall figures of June, July, August and September that furnish a criterion of climate, much though these are responsible for the water-content of the lower layers of the soil—but the period of drought and low rainfall that follows, and the figures furnished by this period that are of importance, in studying the second group of plants.

BIOTIC AND PHYSICAL FACTORS.

At the commencement of the rains the seeds of the first group of plants germinate. When the fields are puddled in the middle of July and commencement of August for transplantation of rice, many of these are destroyed cr seriously injured. Nevertheless, the seedlings stand the ordeal with remarkable resistivity, and are seen vigorously flowering and fruiting, in the midst of the rapidly growing bunches of transplanted rice. They flower from August to October and shed their seeds which are scattered far and wide by the strong breezes and various other agents. The seeds of many of these, as well as, those of some of the second group of plants are killed by the burning of Rab in seed-beds, but those in the other plots remain unaffected.

The seeds of the second group of plants are scattered by wind in the dry months, and by the agency of men and animals working in the fields. The small lease holder has no agricultural implements or animals of his own. He hires these from rich landlords. These are carried through fields bad and good, and thus the seeds of weeds from the worst plots and even from neglected fields, are carried to the fields, best looked after and well weeded. Along with the mud adhering to the feet of these animals and instruments, the seeds of the most troublesome weeds are carried from field to field. The most careful weeding in August and September therefore, is not effective in the complete eradication of these unwelcome guests. Water flows from field to field and the distribution thus made is wide and complete.

COMPETITION.

The soils of the heavy rainfall tracts of Konkan are notorious for their deficiency in Nitrogen, a good proportion of this element being washed out by the first few heavy showers of rain. The plants of the first group are semi-aquatic and have a deep seated but generalised root-system, not different from the root-system of the rice plant itself. The highest reached by the majority of these, except Ammonia baccifera, is also the same as that of the rice plant. The demands of plants growing in such uniform conditions must be very similar. These considerations lead inevitably to the conclusion, that during the growing period of the rice plant after transplantation, there is keen competition for nutriment between the rice plant and the weeds of the first group. These not only deprive the rice plant of its due share of nourishment from the soil, but produce a compaction of the soil by their deep and fibrous roots. This considerably hinders the vigorous growth of the root-system of the rice plant itself. In fields with an inadequate supply of water, competition is set up even for water, as is evident from the stunted growth and poverty in green colour of the rice plant in unweeded plots. The result is a poor yield of rice and straw for the landholder. The plants often become yellow and the seeds though set, are often empty, a direct consequence of the poverty of Nitrogen in the soil.

WATER-RELATIONS.

A study of the water-relations of the second group of plants, leads inevitably to the conclusion that these are directly affected by the moisture-conditions of the particular habitats where they are placed. The depth to which the roots penetrate the ground is directly controlled by the depth of the rains of the season (warm and moist). The persistence of the plants is mainly directly dependent on the length of time the water remains in the soil where they are growing. In years when the wet season is long or there is an unusually heavy rainfall in October and November, such as was the case in 1916, such plants as are more resistive to drought survive longer in the fields and are found flowering and fruiting right to the end of April. Among such resistant plants the following deserve special mention.

Chrozophora-plicata.
Heliotropium supinum.
Mollugo hirta.
Sphaeranthus indicus.
Heliotropium ovalifolium.
Solanum xanthocarpum.
Stemodia viscosa.
do. serrata.
Hygrophila serpylum.
Argemone mexicana.
Xanthium strumarium.

RELATIONS OF THE ROOTS TO NEIGHBOURING PLANTS.

The plants of rice fields vary greatly in their abundance. In fields with an adequate water supply the species form a fairly dense thicket. In years of favourable rainfall and particularly in years when the rains of October and November have been effectively heavy, the plants in some places are so numerous as to completely cover the ground. Since such fields as remain sufficiently moist for a second crop of Wal (Dolichos lablab) or are situated near a supply of water, are generally worked up for a second crop of melons, or other Cucurbitaceous fruits, and vegetables, there is less scope for observation on these moist fields. Besides such fields are generally more carefully weeded and looked after than those that have a shallow soil, or are very far from sources of water. Fields with a good deep soil and adequate moisture, but neglected by the lease-holder for some reason or other, had to be studied for determining the nature of the vegetation on them, and the length of period through which these plants continue to flower and fruit were marked only on these few fields. Nevertheless from a study of three such plots, which were easily found-one in Alibag, one in Mula and one at Revdanda, it was evident that the roots of these plants hold varying relations with each other, which are different in accordance with the kind of habitat they occupy. Blumea is extremely rich in numbers in the fields at Nagaon, and is allowed to hold its own. It flowers plentifully in January and February, in years when the rains have practically ceased at the end of September, and right to the end of April, in years when the late rains of October and November have been effectively heavy. Soon after the cessation of the rains, the superficial roots of the first group of plants, begin to suffer from progressive desiccation of the soil, can no longer remain functional and begin to die. The plants have also by this time fruited and soon die. With the second group of plants it is different. With the drying of the surface layers in November and December, the more superficial roots, which have arisen as laterals of the tap-roots, cease absorbing and rapidly die out. The entire amount taken in by the root-systems of the second group then comes from the deeper levels. In the dry period that follows, the most deeply placed roots, of such plants as Hygrophila serpylum, Chrozophora plicata, are placed in close relation with each other and the competition between these roots for water, now truly begins. The keenness of the competition depends upon, the closeness of the roots, the nature of the soil, the depth of the soil-water, and the nature of the rainfall both in quantity and in distribution. The distribution is of prime importance. If the quantity of rainfall is two or three inches, and falls in one or two heavy showers early in October, then their effect is much less than if it fell in the commencement of November and is distributed in smaller amounts over a longer period. A few heavy showers in November saturate the soil and supplement the supply of water to the lower layers of the soil. The competition for water from these lower layers thus becomes less keen, and the plants flower and fruit right to the end of April.

The tap-root nature of the root systems of the second group, also excludes the possibility of much intermingling. The rhizome bunches of the harvested rice in all fields, and occasional small boulders in some of the rocky fields, are among the only hindrances to a straight tap-root.

A closer study of the roots of plants of the second group in moister fields, showed a marked increase in the output of branches, by individuals growing in less compact soil. In most cases, the root tips of these were alive and often covered with root hairs. While in the more compacted soils of dry fields, the root-tips of the laterals were dead. This consideration leads one to the conclusion that, compaction of the soil is also a great hindrance to the development of laterals.

COMPARISON OF THE ROOT SYSTEM OF THE TWO GROUPS.

The root-systems of the first group of plants are easily distinguishable from those of the second group. The most striking characteristics of the roots of the second group are the prominently developed tap-root and the meagre development of the laterals, which are generally filementous or at least thin. The plants of the first group, on the other hand, have root-systems which are always of a more generalised form.

The absorbing surface of the first group appears to be greater than that of the second group, and the depth of penetration of roots of the second group is evidently greater. All the causes leading to differentiation in the root-systems of the first and second groups, are not known with certainty, but on the probability that they lie in the nature of the species as well as in the difference in the environment of the two groups of plants, the following explanation seems to be nearest the truth.

The rains of August and September in addition to keeping the soil wet, serve to keep it cool. The air-temperature is also low and the humidity high. In brief, there is sufficient moisture in the surface-soil for the plants of the first group to thrive and fruit, and the transpiration period though long, is not such as to prevent the plants from completing their reproductive processes. In the case of the second group, however, the environmental conditions are strikingly different. The October heat has already removed most of the moisture from the surface soil. The temperature of the soil has also commenced to rise higher and higher. The conditions of transpiration become more exacting, and the sub-surface soil is also rapidly losing in soil-moisture. The light showers of rain that are sometimes experienced in October, are too small to materially or effectively change the soil-conditions, and the plants adapt themselves to the more exacting conditions by obtaining moisture from the deeper regions of the soil. This is ensured by the formation of a permanently developed tap-root accompanied by a poverty of laterals, the few laterals that do arise or remain alive serving more as anchorage than as absorbing organs.

The cracking of the soil which takes place in many rice fields in the Konkan, seems to be favourable to these xerophytic forms of the second group, inasmuch as they serve to ensure a more perfect aeration of the deep tap-roots. Since the roots of these plants possess but few laterals, there is little possibility of injury to them, by the formation of cracks. In August and September the temperature both of the soil and of the air, permit on the one hand very rapid growth and on the other the best conditions for water absorption prevail with the result that the root-systems are generalised and well developed. In fact, as a closer study shows, special roots are developed in the more hydrophytic forms. These grow along the surface of the soil and thus ensure perfect aeration.

From October to April on the other hand, the soil is warmer than the air, which tends to increase the rate of transpiration, to limit the development of roots, and thus to make the conditions unfavourable for the fullest growth of the shoot. The result is that the demands on the root-systems are relatively great, and these have to be met by a deep-seated root-system.

From the foregoing brief statement of the leading general differences between the plants of the first and the second group, it will appear that the period July to September may be conceived as favouring hygrophily more than that from October to April. So that the root-systems of the first group of plants can be said to tend towards hygrophily and those of the second group towards xerophily.

We thus find that plants like,

Bergia ammanoides,
Portulaca oleracea,
Aneilima spiratum,
Hydrolea zeylanica,
Euphorbia hypericifolia,
Do microphylla,
Do coccinea,
Do zornioides,

which belong to the second group and yet are characterised by a marked shallow type of root-system, are limited in their normal distribution to situations where they enjoy relatively favourable water-relations. Those however, of the second group, that possess a deep seated root-system, and can therefore stand the desiccating conditions, prevalent from October to April, have the widest distribution.

These are :—

Sphaeranthus indicus,
Chrozophora plicata,
Mollugo hirta,
Gnaphalium indicum,
Stemodia viscosa,
S. Serrata,
Heliotropium ovalifolium,
H. Supinum.

SIZE AND APPEARANCE.

The following plants vary greatly in size and sometimes in appearance, a feature depending on water-relations, more than on any other environmental condition :—

Heliotropium supinum.
Heliotropium ovalifolium,
Stemodia viscosa,
S. Serrata,
Chrozophora plicata,
Mollugo hirta,
Solanum xanthocarpum,
Gnaphalium indicum,
Rungia parviflora.

In February 1917, during the long tour undertaken, many of these were found to be of very unequal size, the difference was so great in some instances as to make sure recognition of these well-known species somewhat difficult, at least on the spot.

Among forms exhibiting this condition, none showed more extreme modification than Hygrophila serpylum, mature specimens of which, growing under favourable and unfavourable conditions as regards water-supply, were found, whose shoots were from 2·2 *cm.* to 44 *cm.* long ; that is there was a difference of 1 to 20 in stature. Stemodia viscosa and Stemodia serrata standing bracketed second.

Nanism or stunted growth is a common character of those growing in the drier parts of moist fields and those in fields with a poor supply of water. The most obvious result of a consideration of these data (though insufficient) is the fact, that the response of the plants to these severe environmental conditions, is met by a well developed deep root-system and a proportionate economy in the shoot growth.

Cannon points out (in his " Root habits of Desert plants") that for desert plants having a generalised root-system, it is probable that the penetration of the roots, the character of the soil permitting, is equal to the penetration of the rains. This finding, of great root-depth co-related with deep soil-moisture, bears out Cannon's suggestion of the probability that the longest and the most deeply penetrating roots are found not in deserts, but where there is a considerable rainfall and where the penetration of rain is considerable, and the water-table relatively deep.

We thus see that a knowledge of the distribution and extent of root-systems, enables us to interprete more correctly the present structure of vegetation, as well as to analyse the causes which have contributed to, and the factors that are constantly operating upon vegetation, and modifying its structure.

SHOOT HABIT.

First Group : Most plants of the first group are aquatic and semi-aquatic. They grow erect and reach almost the same height. Only a few plants that grow on the bunds show a slightly creeping habit.

Second Group : Many of these plants, which are quite woody in spite of their small size, assume the Espaliar shape, that is to say, their stems lie on the ground, are pressed against it and are concealed more or less between other plants, stones, lumps of soil, and such like. Only the tips are directed upwards, almost at right angles and rise above the ground, only a few inches. It is certain that by the assumption of such a position, the plants receive a greater amount of heat than they would, were they erect. It may be, that it is by evaporation resulting from the hot Sun of October, assisted by the strong desiccating winds that this change of shape is induced.

It is not the lateral shoots alone that lie prostrate and radiate in all directions but the main shoot itself bends down and divides. In some plants several shoots arise from the main shoot and radiate in all directions, along the surface of the soil, at right angles to the main shoot, which latter is very short and stout, a spherical thickening being usually formed at the junction of the root and shoot.

These are :—

Chrozophora plicata,
Heliotropium supirum,
H. Ovalifolium,
Mollugo hirta,
Evolvulus alsinoides.

The following plants show a beautiful tomentum or a rich pubescence characteristic of xerophytic forms :—

Gnaphalium indicum,
Chrozophora plicata,
Mollugo hirta,
Heliotropium ovalifolium,
H. Supirum,
Evolvulus alsinoides,
Sphaeranthus indicus,
Xanthium strumarium.
Cressa cretica (in fields near salt marshes).

GENERAL SUMMARY AND CONCLUSION.

The Secondary Formations of rice fields consist of two groups :

I. Hydrophytic and mesophytic forms.
II. Xerophytic forms.

Among the species of the first group there is but little structural adaptation to the dry climate which follows their vegetative activity ; for the active life is passed under favourable circumstances and the adaptive features are brevity of existence and aquatic or mesophytic structure. In the second group of plants the structural adaptation reveals itself. These plants are small shrubs whose leaves and stems are clothed with felted hairs. The plants are often short and stiff and poor in sap. Many of these assume an Espalier shape, possess a deep seated root system with but few laterals. The roots are very much thickened at the crown and are hard and woody. They flower in the driest months of the year.

REMEDIAL MEASURES.

That these unwelcome guests, so injurious to crops, need to be eradicated, for the benefit of mankind, is undeniable. The physiological behaviour of weeds of the first and second group is radically different, and it would appear that the treatment adopted for their eradication should also be different. The following measures for their eradication are therefore suggested for empirical testing of their efficacy.

The weeds of the first group should be completely up-rooted soon after the transplating of rice, always before they have begun to flower, and turned immediately into green manure or fed to cattle.

The weeds of the second group require a different and more drastic treatment. Soon after the harvesting of rice, the fields should be ploughed up and the plants collected, heaped up to dry and subsequently burnt. If followed every year, this treatment will serve not only to destroy all the plants usually present, but also exclude the possibility of new ones finding a suitable home there.

BIBLIOGRAPHY.

Cannon—Root habits of desert plants.
Cook—Flora of the Bombay Presidency.

NOTE:—The reader will be interested to know that among the weeds of Rice fields in Alibag, the following grasses have been known to harbour the destructive Rice Stem Borer, *Schœnobius bipunctifer* (Wek), commonly known as Shir in Marathi. These grasses are:

Ichoemum aristatum Subspecies barbatus.
Andropogon Odoratus.
Anthisteria Ciliata.

It will thus be seen that the eradication of these grasses becomes doubly advantageous (For more details vide Bombay Bulletin No. 68 of 1915, 'The Rice Stem Borer in the Konkan').

We offer our heart-felt congratulations to Professor Knight for his becoming the head of this College.

Our Social gathering, this year, had been very successful; the one feature of this gathering had been the masterly address of Dr. H. H. Mann. The way, in which Dr. Mann spoke, had been very explicit and most sincere; cheers poured in when Dr. Mann described to his audience his "vision" of "India leading all the nations of the world."

Prof. Sahashrabuddhe, at the time, rightly expressed the opinion of the students, when he described Dr. Mann's great sincerity saying that whenever Dr. Mann stands to speak there is as it were thunder in his mouth and lightening in his eyes".

We feel it our duty to offer our sincere congratulations to the Managing Committee of the Social Gathering, with Mr. M. N. Kamat as the General Secretary.

We also highly congratulate the students of this college, for their thoughtful decision of handing over the balance of the Gathering fund for Famine Relief; we hope this public spirit will be kept up by our Students, in the future.

Obituaries.

We are exceedingly grieved to announce the deaths of Messrs. Nazare and Mughal and V. T. Kulkarni. Messrs. Nazare and Mughal were the graduates of our College and were doing excellent work. Mr. V. T. Kulkarni was a student of our College, studying in the Junior Class! He was a promising young lad.

God bless their Souls!

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EDITORIAL.

OURSELVES.

AN artist working at a big canvas cannot proceed very far in his work before he must pause, and step back some distance to scrutinise his picture-in-the-making from time to time. And only thus, by examining in perspective, the whole of what he has done from some distance, can he hope to keep the various parts of his subject in proper relations to one another. The same holds for almost any other walk of life and more broadly for life as a whole.

In attempting to sketch, therefore, for the benefit of our readers and ourselves, the history of our Magazine, we are but conforming to man's very natural tract of seeking to adjust the perspective in all things. That the present number of our magazine is the first of a new magazine year further justifies our attempt to make in it a statement of our policy.

This magazine was born of ideals and necessity just eight years ago. It has been reared on the progress of the college, and men, who have made their mark, have moulded its characters, until to-day it stands as a champion of agricultural enterprise and progress.

What then are the embodying principles that this organ of a better agriculture advocates, the policy for which it stands voicing as it does, the views of such a leading institution of the Government as the Agricultural College at Poona?

It aims to place before the intelligent public modern and original information on agricultural topics vital to the Bombay Presidency from the pens of men eminently qualified in their respective callings. Its place in the agricultural literature of the country almost unique. It does not aim at being essentially popular, but it claims to be a medium of publication of matters of agricultural interest, chiefly applicable to Western India, which are precise, accurate, and nearly always original.

It is for this reason that the Agricultural College Magazine is not perhaps very inviting to any but the student and the actively interested man of agriculture. It has set itself a standard which hardly admits any levity or laxity in its almost puritanic garb and manner, so that to wish to see it less sober and less technical would be to wish to see it with less of the very characters which it has always aimed to possess.

Having thus briefly surveyed the aims and ideals of the Magazine, its policy and its character, we may do well to survey some of its material achievements in the past.

Independent of the Bombay Department of Agriculture, as this magazine has been in thought and initiative, by ever expounding from its pages the principles and practice of a more rational agriculture it has incidently come to be a vigorous advocate of some of the very doctrines that the Bombay Department has been at such pains to spread, now for many years. Thus the history of the teaching of this magazine, on certain common points resolves itself somewhat into a part of the history of the efforts of the Bombay Department of Agricutlure.

It is impossible to estimate at all adequately the tangible practical results achieved in the field through the reading of its pages. But we can say with all modesty that the burning problems of the day connected directly or indirectly with agriculture whether about dairying or about the control of insect pests and plant diseases, whether about the efficiency of Indian labour or the successful working of business or social associations or whether about the most remunerative cultivation of a supremely important crop like cotton or again the difficult problem of agricultural education, have been frequently discussed in its pages and to no small purpose. It has ever tried to serve the cause of a more prosperous agriculture whatever the matter dealt with in its pages.

And here we cannot but feel that when much that we are now preaching has borne fruit, there will be still much to do. The technical improvement of agricultural methods is not all that is needed. There remains behind all technical improvement the figure of the simple mysterious Indian labourer the limiting factor in Indian agriculture if we may be allowed the term.

For indeed to make an Indian labourer in the heart of the country, into an 'economic man,' to make him realise the true relation of work done to time spent, to make him see the importance of conservation of energy for the right work and at the right time, in a word to teach him to be more economical of his time and energy, seems to be a far more difficult problem to solve than almost any other.

But here let us not forget that much rests in our hands towards making better labourers. We cannot continue to pay them the very scanty wages that we do and really expect much better work. They must have something more than the barest pittance to keep life going, if they are to spare time or thought for turning out better work.

We thus see that our short comings in the production of the food, for our stupendous armies, in these urgent times, are partly explained by our inefficient organisation of labour. It is most unfortunate, that while we ought to be straining every fibre of our strength, to summon up our vast potential resources, that in times like these, when to exploit and exhaust the land for fuller returns would be justifiable, we should have still to be content with turning out crops unsatisfactory in quantity and character. This occurs, we repeat, partly as a result of the inefficient technical methods generally employed, and perhaps still more on account of the inefficient organisation of the human element in carrying out the agricultural work of the country.

Fruit for Jam Making in the Bombay Presidency.

BY

G. B. Patwardhan, B. SC.,

Assistant Professor of Botany.

THE Bombay Presidency returns a total area of nearly 63,500 acres under tropical fruits of fifteen kinds. One third of this area consists of cocoanuts which are out-side our consideration from a pomological point of view, although, cocoanut-jam is somewhat made from its fresh meat. The mango comes next occupying a computed area of 17,000 acres containing about twenty-two lakhs of trees. Nearly an equal area i. e. 15,000 acres is devoted to plantains. Guavas take up 3800 acres. Although comparatively smaller areas are returned under such fruits as *papayas*, figs, grapes, lemons, straw-berries, pineapples etc. each fruit is important when considered on its individual merits for jam or jelly making. Altogether 3714 acres are occupied by the remaining nine kinds of fruits utilisable for jam or jelly making or which can be preserved in other ways. Two species may be added namely, *jambuls* and *karwands*, which are forest products available in large quantities and which are capable of being used for jellies. Capegooseberry and mulberry must not be omitted from our consideration, as these are extremely easy to cultivate and as the produce can be used direct for jam or jelly manufacture. Though not generally cultivated by the people evidently for want of a demand, still their culture can be easily taken up by Government farms for demonstration purposes. Plentiful material becomes available in a short time i. e. in a year.

The total yield of fruit, fit for either jam or jelly making or for preserving in other ways such as canning or drying, can be estimated with a fair degree of accuracy. Leaving aside mangoes, of which it is impracticable to make an estimate, and which will be considered separately, I compute an annual gross produce of 190,000 tons. The following table gives details:

No.	Names of fruits.	Areas under fruits.	Annual estimated produce.	Principal districts in which produced.	Seasons in which available in quantity.
		acres.	tons.		
1	Figs ...	475	1600	Poona.	April, May, June.
2	Guavas ...	3812	127,000	Ahmedabad, Jalgaon, Ahmednagar, Poona, Dharwar, Nasik &c.	August to February.
3	Papayas ...	257	6,000	Poona, Ahmednagar, Nasik.	October to March.
4	Grapes ...	467	1,100	Nasik and Ahmednagar	January to March
5	Plantains ...	15,000	54,700 (flesh)	Jalgaon, Poona, Sholapur, Bijapur, Satara, Thana, Kanara.	All the year round.
		20,011	190,400		

In the above statement, custard apples, straw-berries, pineapples are not entered because the area cultivated with them is either too small and therefore the prouduce is negligible or because the fruits are too inconvenient to handle for jam etc. But pomegranates are cultivated in quantity in the Ahmedabad and Poona districts. The produce is mostly exported to Bombay. Besides it is not as easy to utilise these for jam etc., as the others tabulated above.

The distribution of the produce in the districts can be seen from the table below. The principal centres only are entered here:—

No.	Districts.	Figs tons.	Guavas tons.	Papayas tons.	Grapes tons.	Bananas (flesh) tons.
1	Ahmedabad ...	...	11,116	...	...	...
2	Poona ...	1,390	17,712	1,328	133	3,160
3	Jalgaon ...	...	10,279	...	...	2,959
4	Ahmednagar ...	...	8,069	2,936	140	932
5	Nasik ...	...	15,535	1,538	593	
6	Dharwar ...	...	9,709			1,601
7	Thana ...	...	...	...	...	7,806
8	Sholapur ...	...				2,709
9	Bijapur ...	...				4,030
10	Satara ...	...				2,829

A glance at the above statement shows that Poona is the premier place for all fruits. Ahmednagar and Nasik come next in order. It cannot be said that the whole of the produce of each district is brought up for sale at the respective district stations. A part of it is consumed locally even in out-lying villages, such as plantains and guavas. Other fruits namely figs and grapes are consumed very little, if at all, in the centres of production, but almost all are exported to Bombay and even to distant places like Agra, Saharanpur, Calcutta, Bangalore, etc. However, I have no hesitation in stating, that a very large proportion of it is sold at the headquarters of districts or in the larger towns in the districts. The fruit areas are comparatively much more concentrated within a radius of twenty to thirty miles (or fifty miles if approachable by good roads like that from Junnar near Poona) from large town centres than anywhere else. I should say that approximately one-fifth of the total produce is available at central places such as district head-quarters and other towns put together.

Mango Supply.—This fruit is produced everywhere in the Bombay Presidency, but the major part is from the coast districts of the konkan and from such Deccan districts as are favoured with a rainfall of 35 inches or more. About seventeen thousand acres are cultivated with mangoes. In addition there are thousands of trees growing in moist forests. A rough census gives a total of about twenty to twenty-three lakhs of trees of all sizes growing in the Bombay Presidency.

On account of the existence of fruit-yielding trees in all places up to the most distant out-lying district, and the superabundance of the fruit in season, all produce is not well utilized. A good deal is eaten, but a huge quantity is wasted. The waste is due to the absence of local markets, which will utilise the fruit in some way or other, for export. It is often too expensive to take it, even to district head-quarters, since the supply everywhere is very much more indeed than the demand and the fruit is delicate to handle. The chief centres in which this fruit is offered for sale in large quantity and where the market is often glutted in the season are Poona, Nasik, Belgaum, Dharwar etc. I must say again, that, much of the fruit produced does not find its way to large market places but is wasted *in situ*. The whole of it could be forced up to markets by proper organisation of the canning industry.

In the above no consideration has been given to oranges, lemons, and sour limes. The supply of these is concentrated in three places viz., Poona, Ahmednagar and Ahmedabad. In the first two places, we get oranges and sweet limes and the last two supply large quantities of sour limes. The *Seville* oranges of upper India of which marmalade is made are not cultivated in Bombay and therefore not available. A species of fruit fit for marmalade and so used by us, is *Citrus medica* (locally called *mahalung*), which is cultivated as odd plants in orange groves.

It is not possible to obtain the quantities by weight of different fruits actually imported in a year into our large towns. I am indebted to the Chief Officer, Poona Municipality, for giving me the following figures of imports of five fruits in the year 1916–17 into the Octroi Cordon of Poona.

		Poona.		
		Maunds		Tons.
1.	Guavas................	10,402	=	371·5
2.	Plantains............	35,963	=	1284·4
3.	Mangoes.............	26,583	=	949·4
4.	Figs.....................	3,629	=	129·6
5.	Grapes.................	487	=	17·4
		74,064	=	27,52·3

The above will show the importance of plantains, mangoes, and guavas in the fruit supply of Poona City. These fruits only must be immediately utilised.

I give below an approximately close estimate of the present prices, at which the different important fruits can be purchased in the open market. If bought direct from producers *in situ*, the price will be reduced by about 50 per cent. In the latter case, the cost of transport to factory must be considered.

Prices of Fruits.

Name.	Value per cwt. Rs.	a.	p.	Value in situ. Rs.	a.	p.	Remarks.
Guavas ...	2	0	0	1	0	0	At a little over 3 pies per lb.
Plantains (flesh).	10	0	0	6	0	0	At 12 annas to Re. 1 per bunch.
Mangoes (pulp or juice) ...	10	0	0	2	8	0	Approximate only calculated from an estimated quantity of pulp or juice yielded by an ordinary fruit.
Figs ...	23	0	0	10	0	0	At 5 lbs. per rupee.
Grapes ...	112	0	0	40	0	0	At 1 rupee per lb.
Papayas ...	3	8	0	1	8	0	At 1½ annas for one fruit of average weight of 3 lbs.

Figs and grapes are the most costly fruits. The rest are fairly cheap.

Present position of each Fruit.—I give below in short the different fruits and the ways in which various preserved products are made from them by the people of the Bombay Presidency, mostly for domestic use.

1. *Mango*—(*a*) A preserve called *moramba* is made from fruits, which are just beginning to ripen or at a little earlier stage. The skin is first removed and then the central stone. The flesh is then cut into slices which are cooked in concentrated syrup made from *gul* or *jaggery*. Sugar is employed sometimes instead of *gul* but it is dearer. This preparation is put in porcelain or silvered or enamelled metal jars. The preserve keeps well for about 3 years. Every Indian home of moderate means makes at least a little of it every year. Nevertheless, it is not offered for sale on any scale for want of a demand.

(*b*) *Mango cake*.—This is prepared in small quantities in the Konkan and occasionally in the Deccan. This is also a domestic preparation. It is made by sun-drying mango juice in flat shallow pans. The pans are exposed for 4-5 days. The cakes are lifted up and stocked in jars. The cakes are not available for sale in the market on a large scale, for want of a demand, though small quantities are purchasable to a limited extent, in Konkan villages at about 6 annas a lb.

(*c*) Mango pickles and *chutneys* need not be mentioned here.

(*d*) *Canned Juice*.—Mango juice or pulp is now canned on a factory scale by the "Oriental Cannery Co." Honavar, North Kanara district (Manager, Rao Saheb B. M. Basrur). It is offered for sale in Bombay and Poona in half-pound tins and is said to sell well. The Company has agents in Calcutta, Aden, Lorenco Marques (Portuguese East Africa). I understand that some difficulty is felt by the Company in obtaining as many and as cheap tins as they could get before the war. I believe the Company will be able to turn out larger supplies of their products, if, specially encouraged by Government.

(*e*) Raw mangoes are also preserved in salt water.

II. *Jâck fruit cake*.—This is made in the Konkan. It is prepared by sun-drying the pulp of the jack fruit (*Artocarpus integufolia*). The pulp is treated first, by churning, before spreading out for drying. The fruit is abundant and a fairly large quantity of cake is made.

III. *Emblic Myrobalan Phyllanthus emblica*.—This fruit is also locally preserved in sugar syrup or gul just in the same manner as the mango. The preserve is offered for sale in the market of Poona under the name of *moravla*. The price is Rs. 2 to 3 per pound. It is administered against biliousness. The supply is not however large.

IV. *Grapes*.—The berries can be preserved in sugar syrup. It keeps well and has an excellent flavour.

V. *Capegooseberies*.—I have tried these with success in the same manner as grapes.

VI. *Guava*.—Guava jelly and guava cheese is made in some European homes in India but none is offered for sale,

VII. *Citron.—Citrus medica-mahalung.* Marmalade is made from the very thick rind of this fruit. It is made in the same way as *moramba* in many Indian households. The outside skin is removed as also the seeds together with the central core. The thick white mesocarp is cut into slices and cooked in syrup and then preserved in metal vessels. This preserve is given as medicine. It keeps well for a long time. It is not offered for sale in the market.

VIII, *Lemon*—The juice extracted from *kagdi* limes is also boiled with a large proportion of sugar and a little saffron. An excellently flavoured preserve under the name of *sudharas* is made. It is not offered for sale on any large scale.

IX. *Bananas.*

(1) *Chips.* Half ripe bananas are cut crosswise into circular chips which are dried by exposure to sun and then fried in ghee. These chips are afterwards rolled in spices and preserved in bottles. These are not offered for sale.

(2) *Banana flour* is made by drying raw bananas in the sun and then pounding with mortar and pestle. The flour is eaten with milk on fast days by orthodox Hindus. It is not offered for sale.

(3) *Dried bananas* under the name of *sukeli* are made on a large scale and marketed at Agashi, a village in the Thana district. The method consists in sun-drying peeled fruit of the variety locally reputed as suited for drying and known as *rajeli.* The ripe hands are carried to the prepared ground on the plain outside the village. A mat is spread on the ground. The skins are removed and the flesh is spread on the mat, which is exposed all day in the sun. The fruits are gathered in a heap before dusk and before the cold comes on. They are covered over with dry banana leaves during the night. A little ghee is applied to each fruit before spreading to the sun. The drying takes four days. At the end of the time, the fruit is soft, tough, elastic and flattened. The flavour is excellent. The prepared fruit is wrapped in shreds of dry plantain leaves in bundles of a dozen each. The price is about eight annas a pound. The annual yield of dried plantains at Agashi is said to be about 160 tons, worth about Rs. 27,000. This material keeps well for six months only. Dirt is sometimes found deposited on the fruits.

Experiments at Fruit Preservation.–Mango canning. – Some attempts were made regarding this process, in three seasons, in the Ganeshkhind Botanical Gardens. The apparatus used is a 'Steam

Pressure Outfit, called the "National Hotel Outfit No. I", costing Rs. 156 and supplied by the North-Western Steel and Iron Company, Eau Glare, Wisconsin, U. S. A. The working capacity is about 40–50 cans each time. Each can is 4 inches high and has 2⅝ inches diameter. The method consists in freeing the internal pulp, from the skin and the stone, and then slicing. It is filled in the tins. In some cases specially, in fruits of inferior grades only juice was put into the tins. The lid was then soldered, leaving the vent hole open. The cans were then inserted into the retort and kept there for varying periods of time at different steam pressures. The vents were then sealed. In short the operations of exhausting and processing (sterilizing) were gone through, in each case, as per instructions of the makers. The advantages of this apparatus are as follows:—

(1) It can develop a pressure of 50 lbs. to the sq. inch of surface exposed. 10 lbs. of pressure is often used in canning. Steam pressure is much more effective than simple boiling.

(2) A fire can be built under this model. Such a type suits Indian conditions better than a fire-box or an oven.

(3) While effective, it is small and suitable, for two men working together.

In all 653 cans were filled either with juice or pulp. Altogether twenty nine processes were tried. The processes varied as to the method of exhaustion of air in tins, the periods in which the materials were subjected to pressure of varying amounts and the temperatures in each case. The following conclusions were arrived at:—

(1) The 'Alphonso' mango juice kept perfectly after exhaustion for five minutes and sterilisation for fifteen minutes at three pounds pressure.

(2) The 'Cowasji Patel' mango variety retained good colour, and condition, taste etc. when exhausted for ten minutes and sterilised for eighteen minutes at five pounds pressure.

(3) In all cases where the cans were filled with pulp, there was considerable shrinkage combined with a slight deliquescence of the pulp.

(4) The juice of inferior kinds remained in excellent condition, when exhausted for four minutes and sterilised for eight minutes at six pounds pressure.

Further experiments with a view to obtain more decisive results had to be discontinued in the present war crisis for want of tins.

Banana drying. – Some preliminary experiments have been very recently carried out on a small scale in the Ganeshkhind Gardens, Poona. The methods consist in sun-drying the plantains in a box covered with glass and raised on posts above ground. The sides of the box are also glass, and there were holes at the bottom and at the sides through which ventilation and removal of moisture were effected. The fruits were kept inside on glass or on bamboo trays. The reduction in weight on drying is 70 percent. By enlarging the dimensions of the box or erecting a structure somewhat after an English gardener's hot-house large quantities may be handled.

Fig drying. – Preliminary trials in drying ripened figs were also made on a small scale. The fruits were exposed to the sun on mats for five to six days, each fig being turned upside down three times a day. The drying was a success but the colour was not attractive for marketing. The reduction in weight was 66 per cent. Our locally dried figs contain a larger percentage of sugar than the imported material sold in the bazars.

The three experimental trials have not given us any result useful for commercial purposes or for turning out products on a large scale. Still they have convinced us of the fact that success is certain if more earnest and large scale trials are made.

What can be made of each fruit.–1. *Mangoes.*—Pulp and juice of this fruit can be preserved in cans in a syrup containing a small percentage of sugar. There is already an industry, which may be further developed. Mango preserves are made in all Indian homes. A large percentage nearly seventy per cent of *gul* and sugar is used for making it. It is not offered for sale. The same kind of preparation could be turned out on a large scale by introducing tested outfits. Jams and jellies can also be made from the fruit.

2. *Guavas.*—Jelly is said to be made for home consumption in European house-holds. As the fruit is cheap and plentiful, it offers the best prospects of immediate handling. It only awaits the introduction of machinery and tested methods of handling.

3. *Figs.*—These are very dear and available in villages round about Poona, from which places they are exported to Bombay.

Fig preserve can be made. The fruits may be dried either in the sun or in special drying apparatus.

Cultivators should be taught or encouraged to dry them in the sun which can be easily attempted as the fruit is ready and ripe right in the dry and sunniest season.

4. *Plantains.*—The total produce is enormous but is much scattered up to even outlying villages. Large quantities are brought to the large population centres. A very large increase in the supply is generally assured if the demand is steady.

Banana marmalade or banana jam flavoured with a little lemon can be made.

Banana flour and banana flour paste can be made. Whole bananas can be dried either in the vacuum or in the sun. People should be encouraged to dry the fruit and prepare flour. Whole fruits can be sealed in cans.

This fruit affords the widest prospects of immediate utilisation for purposes of storage and preservation. The following preparations are turned out in Jamaica and elsewhere and I see no reason why similar products cannot be made here. The methods of preparation are simple as may be seen from the following notes gathered from Fawcett's book on the Banana.

Banana flour. – Cut up small pieces by knives with nickel or bamboo blades, lay the pieces on stones in the sun, put the dried slices into mortar, pound fine and sift the powder. Two bunches make one quart of flour. If this method of preparation pays, heaps of flour will be produced in the mofussil and sent to market for sale.

Banana figs are prepared in Jamaica. These are said to form a part of army rations in Austria, being a food in small compass, which keeps well. Preserved bananas are made by cutting the sliced fruits length-wise into four. The slices are spread on a trellis-like plank in the sun or kept in an oven. The fruit becomes covered with a sugary powder deposited from its own juices. In this condition they keep for years.

Banana flour paste.—Dry the fruits at first in the oven or sun, then grate them mixed with powdered sugar and sprinkle a small portion of powdered cinnamon, clove or ginger over the flour with the white of an egg to bind all of them together. The mixture is made into small cakes which are dried in the oven or sun. This food is good and nourishing.

5. ***Papayas*** –These are fairly plentiful in two or three localities. Being easy of culture, the produce may be increased to double, or

more in the course of a year and a half. Jam can be made. The juice gives papain. Ripe and unripe fruit can be canned and a company in Siam makes a speciality of it.

6. *Grapes.*—Available in quantity, in Nasik only, but extremely dear. Jam and Marmalade can be made. Grape juice can be bottled or canned.

7. *Capegooseberry.*—Not available even in small quantity. Extremely easy of culture. Measures may be taken to demonstrate its culture. Excellent jam can be made from the berries.

8. *Mulberry.*—Remarks similar to Capegooseberry apply to this. Jelly and marmalade can be made.

9. *Strawberry.*—Supply is limited and very dear. Jams, jellies and preserves can be made.

10. *Lemons.*—(Sour limes) available in quantity in Ahmednagar and Poona. Lemon marmalade can be made and its juice may also be preserved in concentrated sugar-syrup. Lemon syrup can also be bottled.

11. *Pine-apple.*—The supply is very limited in Bombay. It can be made into a conserve alone or with straw-berries mixed.

12. *Jambul* (*Eugenia jambolana*) and 13. *Karvand* (*Carisea Cerandas*).—Both are available in quantities in forests but the trees are scattered. They can be manufactured into a jam or jelly. The *jambul* is the easier of the two to manipulate.

14. *Phalsa.*—(*Grewia asiatica*) Cultivated in Sind and Gujarat to a small extent. A beverage and a jelly can be made.

15. Oranges.—The juice can perhaps be preserved. Orange honey is also made.

Conclusions.—(1) About six kinds of fruits useful either for jam, jelly making or preserving in other ways are chiefly grown in ten districts of the Bombay Presidency.

(2) The total produce of three kinds namely mangoes, plantains and guavas is enormous, but it is too much scattered for the immediate creation of a large industry.

(3) There are three important district centres viz., Poona, Ahmednagar and Nasik where comparatively large supplies are brought to the markets for sale and to which larger quantities could be drawn by the establishment of preserving industries.

(4) At present only two preserved products are offered for sale in the markets viz., dried bananas at Agashi and canned mango pulp at Honavar. The output of the former is about 160 tons annually and that of the latter is not yet well known, but seems limited.

(5) There are several home-made preparations such as mango jam &c. but none is available in the market.

(6) Among the fruits mentioned, there are at least two viz., papayas and plantains whose produce in large quantities could be made ready for the market in the course of twelve to fifteen months from planting and therefore their supply can be increased by at least 30 per cent., if a vigorous stimulus is given by first creating a demand and encouraging people to grow more by example and precept.

(7) Enormous quantities of plantains and mangoes worth several lakhs of rupees are imported into Bombay from the coastal tracts of Kolaba, Ratnagiri and other districts of the Konkan. These must be handled by proper machinery equipment for jam making at Bombay.

Recommendations.—(1) That factories should be established in the first instance at the three district centres indicated. Poona will be the best place to start with, because (a) a large amount of produce comes to market there, (b) expert help and supervision is available there. The factories may be small but they must be equipped with apparatus or outfits suited to canning, fruit bottling, jam and jelly making, fruit drying etc., in fact for all such purposes. The work there should be partly experimental, to deal with such fruits as *jambul*, *karvand* and mulberry, pomegranates and custard apples. It should be partly educational, to train people in household methods of preparation.

(2) Demonstrational industries or outfits should be equipped in places where particular fruits are abundant in season. For instance, plantain drying outfits should be shown at Junnar, Jalgaon, Indi &c. or canning outfits at Belgaum, or jelly-making outfits for guavas at Dharwar, Ahmedabad, Satara &c.

(3) Fruit canning or bottling outfits should be made available by sale, for those, who are prepared to undertake the production of Jam &c. Glass jars are more satisfactory to use than tin cans and I believe the former can be made in India now.

(4) Preliminary laboratory trials can be made in several of these directions.

(5) Through the influence of the Agricultural and Revenue departments, people should be encouraged to allot more land for growing fruit, to fetch more fruit to central markets.

The Mahableshvar Jungle.

BY

W. Burns, D. sc.

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ON first arriving in Mahableshvar one observes that the place is embedded in jungle. Outside each compound the ocean of foliage heaves and subsides. The red earth and the green leaf give Mahableshvar its beauty.

Throughout this jungle are numerous paths, broad and narrow, bare and leaf-bestrewn. To wander along these is a rest to body and soul. At first, one is content merely to absorb the beauty of the forest unthinkingly, but later, one begins to see more and to analyse.

Underfoot everywhere is a thick carpet of dead leaves–all sorts of leaves. The finest bird cannot hop among these without making a noise, and one's own progress across this floor is a series of crushes, startling every living thing near and far. As dusk falls, the nervous wayfarer, his mind full of tales of panthers and hyaenas, starts at every rustle of these leaves and feels glad to arrive at the broad highway.

What happens to all this layer of leaves? Some of it may be swept down the steep hillsides in the rains, or blown into the valleys by wind, but much must decay on the spot, producing rich leaf-mould. If one digs beneath the carpet of leaves one finds a red friable loam with the more durable parts of leaves and twigs embedded therein. On this rich and prepetually manured soil the jungle maintains itself. It is the eternal cycle, soil, tree, and soil again.

One notices that there are no big straight trunked trees on the hill. One must go down into the valley to see these. Why should the tree trunks and branches in Mahableshvar be so bent and twisted? It is possible that the force and fury of the monsoon weather are accountable for this. On every trunk is a covering of moss and lichens, another sign of the moisture prevailing during a great part of the year. Through this layer of moss orchid roots cleave their way up, down and arround the contorted branches. From the centre of this system of roots arises the tuft of leathery orchid leaves, from which, in due time, emerges the superb spray of flowers.

The *jambul* tree (*Eugenia jambolana*) is everywhere. When its flowers open, the wild bees visit them in thousands. The peculiar flavour of the Mahableshvar honey is due to its being largely made from *jambul* flowers. There are several trees in the jungle with poisonous bark or fruit. One of these is the *gela* (*Randia dumetorom*) which puts on new sage green leaves in April. It has formidable paired thorns, primrose like flowers, which change from white to yellow. Every resident in Mahableshvar knows, by sight at least, the fluffy flowered shrub *rametta*, (*Lasiosiphon eriocephalos*) the bark and leaves of which are poisonous. A story is current of the disastrous effects of using a tooth-brush, improvised from a twig of this tree.

Flowers as such are few during the hot weather. The jungle is a mass of greenery now, for it is putting a new foliage. It is a noteworthy fact that the very young leaves of many subtropical trees are pink, brown, or even black. This is noticeable in the mango and the *peepul* tree. A theory has been put forward that this coloration is a screen, like coloured glass, to protect the young protoplasm from the too intense illumination of the sun.

Creeping and climbing plants are numerous. A starry-flowered Jamine (*Jasminum arborescens*) is found everywhere in the forest and its scent is delicious. There is another common climber with leaves like the chewing *pan*, which appears to be a wild species of the same genus *Piper*.

The undergrowth of the jungle is thick and difficult to traverse. The *karri* plant (*Strobilanthes asperimus*) erects its long stout stem in masses here and there. Bracken-like ferns are common in the low growth of the forest, and curious white dried up ferns adorn every stone wall.

One cannot but compare this whole luxuriant mass of vegetation with the dry plains of the Deccan a few miles off. What has made the difference? Water—that terrific monsoon downpour succeeded by heat, gives a stimulus to life that results in this amazing plant population, the jungle.

How to start a private farm.

BY

Rao Saheb M. L. Kulkarni,

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SINCE the establishment of the agricultural department in this country, we are beginning to realise what a farm in the European sense is like. Of course from prehistoric times, long before the agricultural department was thought of, land was cultivated and each scattered plot of ground under tillage was known as a field or garden according to the method of growing and to the crops raised thereon. But the idea conveyed by the recent word "*farm*" is quite different from that of a field cultivated by an ordinary farmer, and my notes regarding "How to start a private farm" are for a farm according to this novel idea. Thus by a farm I mean a field or fields with fencing round sufficient in extent for the proper supervision by a trained manager with sufficient number of work and other cattle, with a stock of suitable improved agricultural implements, a farm house, servants' quarters, and cattle byres, with facilities for water for drinking and for irrigating at least a part of the farm, and also with facilities for grazing and hay making &c.

Such a farm ought to be at least in extent about one hundred to one hundred and fifty acres. Now the question before us would be whether it is possible to get such large areas suitable as above for starting private farms of this type. If this be possible, we may discuss the necessary things required to start such a farm and the advantages from such a one as compared with the cultivation of the present scattered fields not systematised in the same way. There are a number of land-holders in the Bombay Karnatak, who own more than two hundred acres of land. But the great disadvantage in the present system of holding is that the total area though large, is scattered in different directions in small survey numbers, thus causing great inconvenience for work, for supervision, and for the use of improved agricultural machinery &c. Thus the first thing necessary to have a real farm is to have sufficient area in one suitable block. This looks, at first sight rather a difficult problem. But if slight efforts are made by co-operation among land-holders in villages, *bhaubands* of Inamdars, Jahagirdars and Watandars, it is possible by adjustments to turn the scattered small pieces of land into economic holdings of sufficient size, to start farms based on modern ideas.

Having got sufficient area for a farm in one suitable block, it is the first duty of the farmer, to lay it out properly, so that, the running expenses of the farm would be as small as possible in the long run. Laying out a farm is rather difficult, as different crops and different methods of cultivation require different classes of plots. Hence this should be done as carefully and thoughtfully as possible. Roads at suitable distances should be allowed for facility of carting &c., when the crops are standing. Besides, farm roads, if properly laid out, serve the purpose of bunds to some extent. Levelling of the area of a farm is another important item to be considered by a farmer, when starting a farm. There is now a lot of information, so far as the Bombay Karnatak is concerned, gained by experience on the Government farms at Dharwar, Arbhavi, and Gadag. This can be acquired by personal visits to these farms and on discussion on the subject with the superintendents of those farms.

Capital.—The next question of importance, is the amount of capital required to run the farm. Many farmers undertake farming with insufficient capital, or depend upon the profits of the farm for current expenditure. In such a case, when the crops fail, owing to abnormal conditions of season or rainfall, the farmer at once gets into difficulties in running the farm. The best plan, therefore, is to deposit a certain amount in a bank or co-operative society, so that, the interest realised can be used for the current expense of the farm. All the money realised by the sale of farm produce should be credited into the bank as receipts of the farm. The owner of the farm should also receive an adequate amount of pay in coin or in kind. In fact a farm should be considered as property of others and the owner as only a paid manager. The present idea of farmers here as owners of their lands, induces them to utilise the whole amount of the farm produce for their use, which sometimes leaves very little, for the working expense of the farm, in the following season.

Management.—An experienced practical agriculturist with self-interest in the farm is the best manager. In the absence of such a manager a man trained by the agricultural department should be secured for management. Besides the manager, a good deal of the success of a farm depends upon the *mukadam* or foreman and also on the labourers. It is absolutely therefore necessary to secure the best type of men to work on a farm. Now a-days there is a complaint that good men are not available for field work. The writer has some experience with labourers. A great deal of the quality of the work done by the labourers depends upon the way in which the owner treats them and takes work from them. With kind treatment and moderate payment, good reliable men, once secured, will never leave the farm. As they become older and older they become more and more attached to the farm. The best management of a farm shows the least wastage of labour.

Buildings.—The present custom of our farmers is to live in villages and cultivate the different lands scattered in several directions. There is a great deal of wastage of labour in this. By living on the spot, twenty five percent more work is done by the servants, and the manager gets full opportunity to study the details of the farm for the purpose of suggesting improvement and also can control the labour to the fullest extent. The required work, milch, and other cattle for the farm with their attendants should also be provided with quarters on the farm. A well for drinking water both for servants and cattle, a store room, a manure pit, and implement shed are the necessary buildings of a modern farm. If the farm is a big one, with a large area under irrigation or with a dairy attached to it, several other buildings will be necessary.

Implements.—A number of improved foreign agricultural implements are seen in the market now-a-days for sale. Several of these have been tried on Government farms by the agricultural department and the most useful, for a private farm partly irrigated and partly dry, are the following :—(1) the Gallows plough, (2) a Reversible plough such as CTI or Kirloskar, (3) the Sabul plough, (4) a Disk Harrow, (5) the Clipper Drill, (6) a Ridger, (7) a Chaff-cutter, (8) a Stone roller and (9) a Wheat thresher. In addition to these the local wooden implements such as drills, harrows, interculturers are also necessary.

With the above equipment a fairly large area say about 150 acres, partly irrigated, partly dry, and partly left for grazing &c., under a trained manager would be a model farm in the Bombay Karnatak and would return to the owner a permanent satisfactory income in course of time. There is no doubt, that, it is rather difficult to invest a large amount of capital, all at once, in private farming. But it is certain that even by gradual investment in permanent improvements a great change can be seen in a farm after some years. Many people hesitate to invest large amounts of capital in agriculture as the return from land is not immediate as in the case of other professions. The idea is no doubt true, but, at the same time, it must be remembered, that the money invested in improvement of land, is not only never lost, but, in the long run, pays with compound interest.

Branching in Herbaceum Cottons and its Importance.

BY

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THE cotton plant has a central or main stalk bearing two kinds of branches, vegetative and fruiting. A number of vegetative branches are known as wood-limbs or limbs. At each of the remaining joints the central stalk bears two branches one vegetative, like the limbs and the other fruiting The latter produces flowers and bolls and is therefore of great economic value. The vegetative branches (limbs and axillaries) do not bear any flowers but produce them on their secondary fruiting branches. The primary fruiting branches (on the central stalk) appear early in the season while the secondary ones appear late, often so late as to be of no account. Moreover all vegetative branches injuriously affect the growth of the primary fruiting branches, the limbs by ever-shadowing and the axillaries by robbing their nutriment. It is for these reasons, the vegetative branches may be likened to so many parasites which grow at the expense of the productive parts.

The above opinion has been formed by continued careful observation, but some people who have seen a number of flowers and bolls on the vegetative branches may however doubt it. It is the experience of many cotton growers, that fields of large luxuriant plants produce very small crops This is because, the branches rarely obtain favourable conditions for setting and maturing a crop. They make a great demand on soil—water, and by the time they flower the supply often fails and the young bolls fall off as soon as they are formed. Thus in the majority of the cases, the vegetative branches do nothing but exhaust the soil.

There is however one particular case wherein the branches play a prominent part. In some varieties when the growing point is nipped the limbs grow long and straight, almost like the main stalk, flower early, and bear well. Nipping therefore was once believed to increase the yield of all cottons and cultivators were recommended to do it, as one of their regular operations. At present, although the opinion of experts is divided, there are many (including the most practical cotton growers) who still regard nipping as beneficial. The reason however is simple. The bushy cottons, such as Broach, are certainly benefited by nipping, as this process leaves only a few branches on the plant, instead of allowing the latter to waste its energy in putting forth a large number of them The writer has also found in this connection that plants nipped at twelve inches high are more productive than those nipped at fifteen to eighteen inches, which shows, that the fewer the branches, the better. Nipping therefore makes a bushy plant less bushy and is profitable only when it checks the vegetative growth to some extent. On the contrary it is injurious in the case of erect cottons as it encourages the undesirable vegetative branches and thus makes them bushy and late. These facts clearly demonstrate the uselessness of rank vegetative growth in any cotton.

Some of the most valuable cottons grown in this country are remarkably bushy in their habit of growth and our object therefore is to make them erect or as little bushy as possible. Nipping, though useful in partly checking the vegetative growth, is very ineffective for our purpose. What we want is the central stalk carrying healthy fruiting branches with no limbs or axillaries to interfere with their functions. Such a type can be secured by culture or breeding. In America, Cooke has found out a new system of culture, for suppressing the limbs. It consists in sowing the seed thick and allowing the plants to grow crowded in the rows. This checks the growth of the limbs, after which the plants are thinned just to avoid the overcrowding of the fruiting branches. This method of single stalk culture seems to be very successful in the case of many American varieties as it has gained much popularity in that country. But it has a limited application here.

The Indian cottons can be divided into three groups as regards the difference in branching:- erect, semi-erect and bushy. Erect types are almost limbless. They do not produce many vegetative branches even under the most favourable conditions. For all such cottons therefore the single stalk culture is superfluous. The semi-erect varieties produce a number of limbs from their lower joints, but the greater portion of their central stalk, bears prominent fruiting branches. If therefore the limbs are suppressed by the new system of culture, the plants get all the advantages of the erect type· Consequently it is the semi-erect type which is most benefited by the culture. The third division which includes many of our *herbaceum* varieties is remarkable for the extra-ordinary growth of the vegetative parts. The limbs are many, occupying a considerable portion of the main axis. The primary fruiting branches are consequently few in number and many of them are nominal, being smothered by the axillary vegetative branches growing vigorously by the side. For controlling the limbs, therefore, the plants must remain crowded in the field for a long period, which itself is sufficient in many cases to spoil the object, by stunting the growth. Again when the limbs are checked, the axillaries come up with extra-vigour after the final thinning, allowing thus, little or no advantage to the fruiting branches. For these reasons the single stalk culture has no value in the case of bushy cottons. The only remedy therefore lies in selecting or breeding erect strains.

Most of the cottons cultivated here are not quite pure. They are a mixture of two or more types and it is often much easier to select the more desirable type which breeds true to its characters. In selecting for the habit of growth, however, other valuable qualities such as the ginning percentage and the staple should not be lost sight of. In fact the selected plant should have a combination of all the good characters at their best. For example, the Kumpta cotton of the Karnatak has two types, one erect and the other bushy. The erect is in general, tall, early, productive, good stapled but low-ginning. By selection however, a combination of high ginning and good staple has been secured and the plant which had this combination has given us a fixed strain which is superior in all respects: It is this strain which under the name of "Dharwar I" is fast gaining popularity in the Bombay Karnatak.

In Broach and Ghoghari cottons the writer has observed many semi-erect plants. The erect type seems to be rare though not altogether wanting in these varieties. As the semi-erect plants respond well to single stalk culture their selection is bound to do some good, but the best results can only be obtained by the erect plant. The erect type in *herbaceum* cottons seems to have originated from natural crossing in the field. Cotton merchants bring the *kapas* of '*neglectum*' and '*indicum*' varieties for purposes of mixing, in order to improve the colour or staple of the *herbaceum*. The seed naturally creeps from the ginning factories into the field. The writer has come across pure *neglectum* and *indicum* plants in a number of fields of the Kumpta variety especially in the neighbourhood of Hubli which has a big cotton market. These cross, and eventually produce the erect type. Some erect plants in Kumpta were found to possess certain of the characters of *Bani*; and a few split as if they were artificial hybrids. These facts indicate the possibilities of breeding the erect type by using the the *neglectum* or *indicum* varieties as one of the parents in crossing.

Cambodia Cotton in the Bombay Presidency.

BY

H. B. Kulkarni, B. Ag.,

Ag. Superintendent, Dharwar Farm.

CAMBODIA cotton is a variety of the *hirsutum* type and is a native of Cambodia in the Indo-China Peninsula. Seed of this variety was first brought into the Bombay Presidency from the Philippine Islands, and it was tried on the Surat Farm in 1904. It was sown in May and grown under irrigation. Next year it was transferred to the Dharwar farm and four more types of the same variety, three from Indo-China and one from Madras, were also tried along with it under dry conditions, being sown at different times of the season. After a trial of three years on the Dharwar farm, these cottons were shifted to Gadag a place in the centre of the Dharwar-American Cotton tract where the so-called "Sawginned Dharwar" cotton established itself many years back. This last locality suited the Cambodia cottons exceedingly well and of them all the Madras Cambodia proved itself superior to others. Therefore attention was diverted to this type only and its superiority over the local "Sawginned Dharwar" in ginning percentage, yield, colour, staple, resistance to red leaf blight, &c. tempted its introduction in the district.

The early trials in the near neighbourhood of Gadag encouraged its further propagation. Therefore in 1910, 2000 lbs. of seed obtained from seed cotton, purchased by the agricultural department at a higher rate from the cultivators who were first entrusted with its trial, were widely distributed. Next year, in Gadag, Ron (Dharwar) and Shirhatti (Sangli) talukas, more than double this quantity of seed, received back from reliable large cultivators, was again distributed. For its all-round superiority a proportionate higher price was expected for this cotton. But the local merchants refused to pay an adequate price and it was therefore decided to hold a special auction sale of this cotton. The object was to invite merchants or their agents from all parts of the Bombay Presidency to show them the better cotton offered to them and thus to create a buying competition so as to get the proper value.

The first auction sale held in April 1912 carried out the intended object beyond expectation and these sales have been since continued. The prices of seed cotton obtained per *naga* of 1344 lbs. in the public auction sale held at Gadag during the last six years are as tabulated below. The prices of the local Dharwar-American ("Saw-ginned Dharwar") and Kumpta cotton on the days of the auction sales are also given.

Prices in Gadag per 'Naga' of 1344 lbs. on the days of the Auction Sale.

Date and year.	Local Kumpta.	Local Sawginned Dharwar.	Cambodia of different grades.							
			Purified.	Special.	I.	II.	III.	IV.	V.	Unclassified.
	Rs.	Rs	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
14-4-12	136	134	...	...	206	200	203	188	120	...
1[illegible]-5-13	138	141	200	185	180	175	166	162	161	...
19-4-14	125	123	...	196	187	180	177	172	166	...
9-5-15	106	106	...	154	145	146	140	140½	135	132
14-5-16	154	153	...	...	221	208	196	206	195	...
20-5-17	175	175	...	285	266	257	255	254	252	243

The high prices obtained in the first year attracted the eyes of the cultivators of the Dharwar-American cotton tract and next year every body went in for Cambodia cotton. So that in addition to the 17000 lbs. of local seed, 20000 lbs. of seed were ordered from the Madras Presidency where it had then become highly popular as an irrigated cotton. Even this large quantity could not meet the demand and the supply was consumed long before the sowing season. Unfortunately the crop failed in that season and the increasing popularity of the cotton received a serious check. The diffidence that then sprung in the minds of the cultivating public was rooted so firmly, that the next year *i. e.* in 1913-14, this variety was grown, on area of only 1500 acres in the Gadag and Ron talukas. Since then, principally some villages in Gadag and Ron talukas and to some extent in Haveri taluka in the Dharwar district, Bagalkot, Bagewadi, and Hungund talukas in the Bijapur district, and Yelburga taluka in the Nizam's Dominions are the only talukas growing this cotton. In spite of the normal growth and better yields of the variety and the strenuous efforts of the agricultural department in securing high values by holding auction sales, the progress in the spread of the variety is very slow as may be seen from the table below:—

Year.	Quantity of seed distributed.	Approximate area under the Cotton.
	lbs.	Acres.
1912-13	37,491	4,000
1913-14	16,333	1,500
1914-15	20,070	1,200*
1915-16	13,600	2,000
1916-17	22,936	2,300

* Seed purchased for this season was kept for next season at Government suggestion to reserve more area for wheat.

Lately the variety is becoming popular as a *kharif* or *mungari* crop in the Haveri taluka of the Dharwar district where the local "Saw-ginned Dharwar" is being grown as such.

The comparative yields of this variety and the local Dharwar-American cotton (saw-ginned) as got on the Gadag farm under normal conditions of cultivation during the last six years are as below:—

Year.	Yield per acre in lbs.	
	Dharwar American	Cambodia.
	lbs.	lbs.
1910-11	249	395
1911-12	79	193
1912-13	431	204*
1913-14	330	340
1914-15	271	303
1915-16	164	120
Average yield for six years ...	254	259

* 1912-13 was a year of general failure of Cambodia cotton by excess of rain when the crop was very young.

The ginning tests of this cotton as taken from the samples of cotton grown on the Gadag farm show a steady high value viz: 38 per cent of lint on the seed cotton. But the tests taken at the auction sales held by the agricultural department show a slight deterioration as may be seen from the statement below. The figures taken do not show accurate consistency.

Class.	Percentage of lint in seed cotton.	Percentage of each quality in each year's auction.					
		1912	1913	1914	1915	1916	1917
	%	%	%	%	%	%	%
Purified.	38	...	7·61	20·03	...	...	...
Special.	37	...	6·86	0·50	3·65	...	·70
I.	36·5	14·01	12·66	10·86	6·39	34·15	4·05
II.	35·5	36·36	28·85	22·24	35·21	35·18	8·30
III.	34·5	7·57	19·67	31·57	19·85	36·98	28·29
IV.	33·5	11·74	12·71	10·52	14·85	14·40	33·35
V.	32·5	30·30	11·60	4·24	6·22	9·27	17·25

From my observations of the crop in the district from 1912 to 1917, I am led to form the following opinion as regards the cultivation of this variety.

It is affected to a greater or less extent by each factor concerning plant growth. The most important factors seem to me to be (1) soil, (2) rainfall, (3) manure, and (4) time of sowing ; and the lesser important factors are (5) rotation, (6) level of land, (7) mixture of subordinate crops, (8) distance between the plants and (9) after-treatment of the crop.

A short note on each of these factors is given below:—

(1) *Soil.*—The soil best suited to Cambodia cotton is a medium black soil, very fairly drained. Deeper and light black soils and *karal* lands are not quite suited. Rich, deep-red soils can also grow this cotton fairly well. In other words those lands of the Dharwar and Bijapur districts, where Dharwar-American cotton now grows, will suit Cambodia.

(2) *Rainfall.*—A well distributed rainfall of 20 to 25 inches is quite sufficient. The chief noteworthy point is, that continuous rain amounting to eight to ten inches within a few days, when the crop is very young, is almost fatal to this cotton.

(3) *Manure*—Heavy fresh applications of manure common with some careful cultivators, do little good even with good rains; and in case of scanty rainfall heavy dressings do injury to this variety. Light fresh applications or residual manure of heavy dressings given to the previous crop is quite suitable,—more so in years of favourable rains and less so with scanty rains.

(4) *Time of sowing.*—This is one of the very important factors. Early sowing favours wilt, shoot borer, and red leaf blight. Late sowing, as late as the first fortnight of October produces a very healthy crop. This does not apply to the *mungari* crop of the Haveri taluka.

(5) *Rotation.*—Cambodia after *kharif* jowar does very well and then follow the crop taken after *rabi* jowar and wheat. Cotton after cotton gives a very poor crop, much more so, when, there is no manure; even in manured lands, the crop does not thrive well after a previous crop of cotton.

(6) *Level of land.*—Level land is quite good when other conditions are favourable. In uneven lands the higher levels suffer rapidly, especially when the rainfall is scanty and the lower levels and washings suffer more when the rains are heavy.

(7) *Mixture of subordinate crops.*—The common practice of mixing *rabi* jowar and other subordinate crops such as *kulthi* in cotton is detrimental to this variety and the greater the mixture the more the harm.

(8) *Distance between the plants.*—Too thick or too thin sowing will never do. If the crop is thick no branching is induced and consequently there is less bearing. If the crop is too thin there is too much vegetative growth which favours the attack of aphides. The proper distance between the rows should be twenty four inches and that between the plants within the rows, fifteen to eighteen inches.

(9) *After treatment.*—Lastly, the after-treatment of the crop also tells a good deal on the condition of the crop. Better preparatory tillage and timely after-treatment favours healthy and

vigorous growth. The crop is altogether smothered up by delay in interculture especially when the crop is young and the weeds are many.

In short, Cambodia cotton is a crop which responds well to favourable conditions, but is easily susceptible to those which are unfavourable and is hence a somewhat delicate crop.

So far there has been no plant to plant selection work undertaken. Variations in ginning percentage and staple, seem to be occurring and to have continued for this reason only. To attain uniformity of characters and to achieve improvement in all possible directions botanical selection in the variety, will be begun at an early date.

Plantain Cultivation in the Jamner Taluka of East Khandesh.

BY

K. D. Kulkarni.

THE cultivation of plantains is carried to perfection in some villages of the Jamner taluka and as the method of planting and of cultivation is rather peculiar, compared with other talukas of East Khandesh or other parts of the Deccan and Gujarat, a short description may be useful, more especially as suggesting trials elsewhere on similar lines. There are three villages, Shendurni, Mangaon, and Pahur that use the peculiar method of double planting described below. At Mangaon the crops are the best and hence a description of a garden of Mangaon is given there.

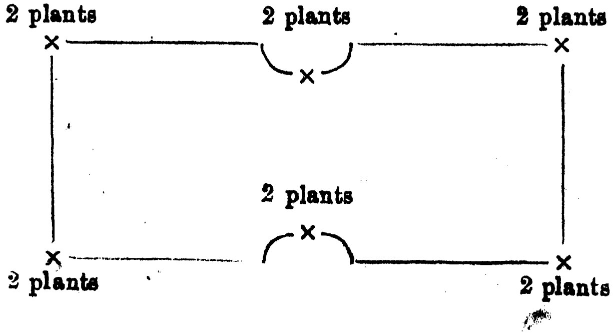
The soil of the garden in question is a medium black cotton soil, eighteen inches deep, with a subsoil of yellow earth mixed with *kankar*.

The variety grown is *Basrai*, which is generally grown throughout Khandesh. The shoots are planted in the month of June with the rains, *two at each place*, at an acute angle at a depth of nine inches, in furrows made with a plough six feet apart.

Before this the land is ploughed from four to six times with a country plough both in the direction of the length and again in the direction of the breadth of the field. The land is manured with sixty carts of farmyard manure per acre. The number of plants per acre is 2400.

Side digging is given to the crop three times, first in September, then in April and then in June, to a depth of eighteen inches.

The beds are prepared and in six places at a distance of six feet apart on the border of each bed, the plants are planted, and a water channel runs on each side of the line of such beds. The stem



is thus earthed up in the regular digging, while the dry leaves removed from the stem are allowed at once to rot in the beds.

In Khandesh under the usual system, at the time of planting plantains the stem is sliced all round, keeping a round cocoanut-like form but here the stem is kept one foot high with the bottom clean shaved but not sliced. Plants that are planted with the rains, start flowering after seven months, full bearing being found after ten months. The ripening of the fruit takes three months after flowering and the full season is from *Ashadhi Ekadashi* to *Kartiki Ekadashi* that is to say from the middle of July to the middle of November. The loss due to wild pigs, wind, and other causes comes to nearly four hundred plants per acre and thus two thousand bunches are got fully developed on this area.

The side shoots are always cut from the sides of the main stem, to keep the vigour of the plant but after the crop is mostly harvested, some side shoots at the end of the season are allowed to grow for the next planting. These shoots fetch Rs. 20 per 1,000 on an average when the price is Rs. 10 per 1,000 in other localities.

Watering is given for every fourth day in summer, while in the rainy season, it is stopped, but if there be breaks for more than a week the crop is watered. In the cold weather water is given every eighth day.

The number of plantains on each branch varies from 120 to 200, the average being 150. In the ordinary gardens in Khandesh the average is only 75 but the people here make a point of selection. They take good vigorous shoots from plants that yield the highest number of plantains and this is continued year after year. This selection is also partly responsible for such a high yield. The variety is not perfectly pure, as here and there a plant with a yellowish green stem is found that ripens its fruit to a yellow colour while the true *Basrai* remains green in appearance though fully ripe.

The rate per 1100 plantains is Rs. 5 to Rs. 7 according to the size of the fruit. Thus the 2000 plants yield 300,000 plantains and thus fetch Rs. 1600 per acre. Here sometimes the bunches are sold at Rs. 60 to Rs. 80 per hundred bunches, according to the number of fruits on each bunch. The ripe fruit, cut three months after flowering becomes ready for the table in three to four days, but the bunches are generally cut two months after flowering for convenience of transport to long distances by cart and rail.

Green Manuring with Sann Hemp in the Ahmedabad and Kaira Districts.

BY

G. B. Pathak, B. Ag.

IT is peculiar to find that in certain portions of such a generally dry area as in the Ahmedabad and Kaira districts, rice is the chief grain crop. In the Sanand and South Daskroi talukas of the former, and in the Matar taluka of the latter, it is recognised as occupying the most important position. Certain places too are renowned for the quality of their rice, and among these, Modasar in Sanand, Vasai, Naj and Mahijada in South Daskroi and Dhathal, Bharai, Navagaon and Nayaka in Matar are specially famous.

The rice crop is recognised in this area to need fairly intensive manuring, but farmyard manure is so scarce that it is by no means always available, and castor cake, the only substitute known to the people has become very dear in the last few years, owing to the constantly increasing demand from the Deccan.

The people are well aware of the good effect resulting from the burial and rotting of grasses such as *samo* (*Panicum miliare*) in the rice fields (*kyaris*) and the cultivators have been accustomed to collect and bury green *zils* plants (*Tephrosia purpurea*). In the Prantij taluka (Ahmedabad) the cultivators have been accustomed to sow *bajri* on the rice fields with the first rains. If the rains are not good this is allowed to stand and a crop is obtained ; if on the other hand the rains are sufficient, the growing *bajri* crop is ploughed into the land, and allowed to rot and so gives a higher yield of rice. In the Kapadwanj taluka the flowers of the *karanj* tree (*Pongamia glabra*) are collected and applied to the *kyaris* as manure. Green manuring is hence not unknown, but the use of *sann* hemp for this purpose can only be done where the rain is sure, or where there are facilities for irrigation.

With the need for green manuring in view, we have conducted experiments for several years on green manuring with *sann* hemp, first on a plot specially rented for the purpose at Ashlali, and afterwards on cultivators' fields at Ashlali, Lanbha, Jetalpur and Bareja.

In plots in which green manuring has been carried out, the planting of rice is delayed by a week or two. Such plots are liable to suffer if the late rains are deficient, and if the canal water is not available. Further *sann* hemp grows very luxuriantly in *goradu* soils, while in *kyaris* on black soil, it remained stunted and was damaged under heavy rainfall conditions after sowing. Another disadvantage was that the land under green manuring could not be cropped with another food or fodder crop if the season proved unfavourable for rice. Thus the opening for the use of *sann* hemp is somewhat restricted. The cultivators however now realise that under favourable circumstances, it forms a cheap and very valuable manure available in any quantity, for the rice crop in the canal irrigated tract.

The actual results of experiments are shown in the following table :—

Manure per acre.	Yield of rice (grain) per acre.			
	1912–13.	1913–14. (Sutarsal)	1914–15. (Jirasal)	Average. 1912–1915.
1. *Sann*-hemp green manure (60 lbs. seed) ...	1,780 lbs.	2,284 lbs.	2,820 lbs.	2,294 lbs.
2. *Sann*-hemp green manure (160 lbs. seed) ...	1,324 lbs.	1,821 lbs.	2,171 lbs.	1,772 lbs.
3. Indigo green manure (13 lbs. seed)	2,600 lbs.	1,150 lbs.	2,250 lbs.	2,000 lbs.
4. 16 carts farmyard manure ...	...	1,680 lbs.	2,272 lbs.	1,976 lbs.
5. 600 lbs. castor cake ...	2,000 lbs.	1,769 lbs.	2,584 lbs.	2,117 lbs.
6. Sheep folding ...	...	1,225 lbs.	2,000 lbs.	1,612 lbs.
7. No Manure ...	2,040 lbs.	1,333 lbs.	2,133 lbs.	1,835 lbs.

The benefit from the *sann* hemp is very clearly shown in these figures, especially in view of the very small out-of-pocket cost of the treatment.

In the experiments on cultivators' fields in 1916–17 in various villages, the following figures are typical of the results :—

	Yield per acre *without* green manuring.	Yield per acre *with* green manuring.	Increase.
	lbs. per acre.	lbs. per acre.	lbs. per acre.
I. Bareja.	1,200	1,752	552
II. Ashlali.	1,179	2,080	901
III. Ashlali.	1,371	1,955	584

The advantage is obvious and clear.

Different forms of waste weirs constructed by the cultivators in the Deccan.

BY

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I have on several occasions written in these pages that though the cultivator in the Deccan is at a disadvantage on account of his inability to use scientific methods and improved instruments, yet he is intelligent and knows much about his work. The same fact will be brought out perhaps with greater force, by what I am going to write about the different forms of waste weirs used by them on systems of *tals.*

The following represent the different forms of waste weirs used by the cultivators :—

I. *Well-waste weir.*

I shall call this form of waste weir as a well-waste weir because in its form it resembles a well.

This is generally used to discharge the flood waters across a field embankment and where this water is delivered directly in a natural drainage channel. It primarily consists of a well built in the lowest portion of a field with a parapet wall rising above the surface of the ground. The top of the parapet wall represents the crest of the waste weir. When the water level in the field near the well rises above the top of the parapet the water rushes in the well from all the sides. The depth of the well is sufficient to have its bottom a few feet lower than the bed level of the natural drainage channel in which the water is finally delivered. The bottom of the well is made strong enough to stand the force of falling water. This well is connected by means of a culvert with the natural drainage channel. The floor of the culvert is kept level from the well to the point of delivery and is a few feet above the bottom of the well. This provides a water cushion protecting the bottom of the well. The floor of the culvert is paved. As the floor of the culvert is level, some of the force of water is lost before it reaches the bed of the natural drainage channel and thus it is protected against erosion and because it is paved the bed of the culvert is not eroded. Over the top of the culvert rests the embankment. The embankment above the arch is generally sufficiently high and wide, to be strong. The waterway through the culvert is sufficient to carry away the flood water. It is necessary that there must be sufficient head on the out-going water during floods when the natural drainage channel may also be in floods. The accompanying drawing represents the section of such a waste weir. The design is good and requires very little modification.

II. *Waste weirs at one or both ends of the tal.*

This form of waste weir is adopted when there is high ground on either side of a *tal* where the soil at the end or ends of a *tal* is hard, where the water is not to be allowed to flow in the lower fields and in some cases where the water is to be taken down for irrigation.

In such a case the main body of the embankment is generally of earth and the end of the embankment is protected by pitching. The top of the embankment is about two feet above the level of maximum flood.

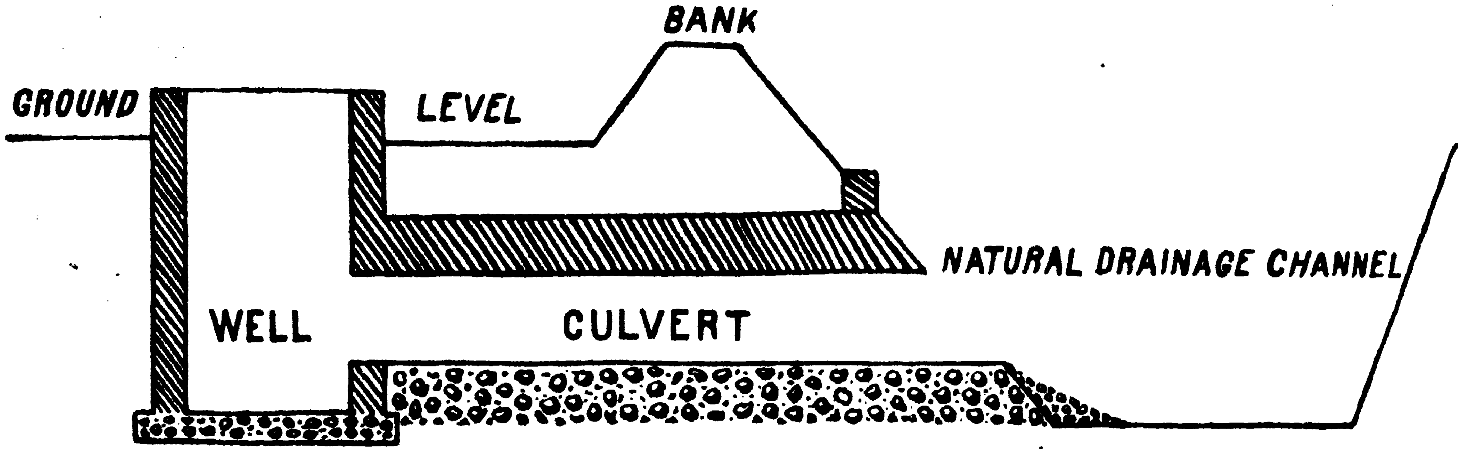
It is better to protect a portion of the *tal* built in the lowest portion of the *nalla* by pitching along the upstream slope. This is very rarely done by the cultivators. The downstream side of the bank to a height of a foot or so above the level at the downstream toe should also be protected by pitching when the flood water after passing through the waste weir passes by the side of the *tal* before spreading out in the lower field.

III. *Waste weir in the original position of the nalla.*

This form is selected when the boundaries of the field do not allow the construction of the waste weir at the end of the *tal*, when the sides and bottom of the nalla consist of hard material (at least harder than what is obtained at the ends) and where there is no objection to allow the water to flow in the lower field.

SECTION

SCALE 10 FEET TO ONE INCH.



In such a case the waste weir is constructed of dry stone masonry but in most cases the masonry is not well connected with the earthen embankment on either side and in some cases this causes a failure of the bank. If the ordinary rules of connecting the masonry and the earthwork be obeyed a large number of *tals* will be protected against failure.

Some times a supplementary waste weir is provided in the form of a rectangular orifice. The top of the orifice is six inches or a foot below the top of the bank. This is intended to carry away, at the time of high flood, a portion of the flood water and thus prevent the water from rising so high as to be dangerous to the bank.

IV. *Water flowing over the entire length of the tal.*

This form is generally selected where stone is easily obtainable. Rarely have I seen stones regularly quarried for this purpose. Wherever stone is available near the surface and is in close proximity to the site of work it is used. Also it is used on steep slopes or where the discharge assumes some magnitude. Except on steep slopes of the sides of a hill this latter course does not determine so much the kind of material used. In some cases the entire surface of the land is covered by stones of varying sizes and then these stones are picked up and are used for the construction of *tals*.

The entire length of the *tal* being of stone, flood water is allowed to flow over it and there is no such thing as a waste weir. The water therefore in approaching the tal does not cut a channel in the field protected by *tal*. There being in almost all cases ample room for the flood waters to pass, there is no danger of the failure of the *tal* for want of sufficient space to discharge the flood water.

V. *The pipe weir.*

Pipes are used for the conveyance of flood water when its quantity is expected to be small.

Iron, earthenware or burnt clay pipes are used for this purpose, the last named being the cheapest and obtainable at any place. By increasing their thickness they are made sufficiently strong. They are obtained in very short lengths generally not more than 18 inches and are not therefore made to extend on either side beyond the face of the bank. The bank on the down stream side is washed away on this account. This can be protected by building a dwarf wall to support the line of tiles until it is taken beyond the toe of the embankment. The same objection holds in the case of earthenware pipes but does not exist in the case of iron-pipes. These last will however require supports at few places in the outstanding lengths of pipes.

Rats Infesting Cocoanut Palms.

BY

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THE rat is one of the most destructive animals of cocoanut planting. It makes its nests in the fibrous network at the base of the leaves and in thick plantations may live together on trees themselves, migrating from tree to tree by way of interlacing leaves, without ever coming to the ground. It attacks tender leaves as well as mature nuts. It is a source of great nuisance to the gardener and does a considerable amount of damage. To quote a singular instance, as many as four hundred nuts have been known to have fallen from six cocoanut trees in one year owing to the depredation of rats.

Remedies—When cocoanut palms become infested by rats the first essential is to dislodge them from the crown of the trees. This can be easily done by searching the trees and clearing them of any nests made on them. Traps or poisoned baits may be kept but they are only temporary measures, because, rats are extremely cunning animals and at once become wary on the slightest suspicion of danger.

The best way of preventing rats from going up any tree is to have a tin sheet fixed round its stem. A trapezoidal piece of tin with the higher side three feet and the lower side five feet long, with a breadth of one foot may be taken and wrapped round the stem. The shorter side should be nailed down to the tree and then it sits like a frustrum of a cone. The tin should have a serrated border below. The tin sheet being smooth all over and besides fixed in a slanting direction, affords no hold for the rats and successfully protects the trees. Beyond this, the only things :that are necessary are that the trees should be searched beforehand and vigilant care should be taken afterwards to see that trees having tins are not touched by others having no such tins, because then the rats may get an easy ladder to come over from one tree to another. If the plantation is very thick and if it is not possible to separate the trees, a group at a time may be taken and searched and the tin applied the same day.

An experiment with a view to test the efficiency as wellas the economic value of the method was made in two gardens in the Alibag *taluka*, and for this a continuous record of falls of nuts caused by rats for one year was maintained. The figures were recorded from two gardens—one having 200 cocoanut trees and the other 350 trees. The rat falls from both of these gardens were :—

Garden.	No. of trees (having no tins).	No. of falls in one year.	No. of falls per tree.
I.	200	1000	5
II.	350	1750	5

So the number of fruits fallen is 5 per tree. If we take the price of each nut as one anna the loss per tree is five annas, and for one hundred trees that loss would be rupees 32. To apply the tins the expenses per tree comes to seven annas (pre-war rates), six annas is the price of the tin and one anna for tarring and fixing. For one hundred trees the expenses would come to rupees 44. So in the first year taking the figures of nut falls as they are, the owner of a garden will have to spend about Rs. 12 more per hundred trees than he saves. Now, supposing the durability of the tins to be five years, (surely the tins will last for more than five years) the profit for the first sixteen months will be required to cover the expenses and he will reap the full profit for the rest of the period. In five years the owner of a garden can save-in other words get Rs. 160, by preventing the nut-falls, out of which only 44 are to be spent as the initial expenses. So the net profit at the end of five years will be rupees 116.

The figures that have been recorded are from two gardens and for one year only. It would have been better had the figures been taken from some more gardens and continuously for five years and the expenses and profits to be worked out thereon. Because there are years in which the rat-plague is excessive and also some gardens are more exposed to or suitably situated for the rat attack. However, the data so far collected are not less valuable, but, are quite sufficient to prove the efficiency and economic value of the method.

The Agricultural Labour Problem in Western India.

BY

V. K. Kogekar, L. Ag.,

Divisional Superintendent of Agriculture.

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(The subjoined article was a paper presented to the annual meeting of the Bombay Agricultural Graduates' Association in December 1917).

ONE of the most pressing problems wherever we go in Western India at present is the dearness and the scarcity of labour. When we talk of doing anything, whether in household work, in manufacture, in building, or in agriculture, we are at once faced by the question as to how the labour necessary is to be obtained, and the high price, compared with what was the case a very few years back, which has to be paid for it when it is obtained.

Limiting our attention to the problem of agricultural labour, we may at once note that it exists in its most acute form in the irrigated areas, though it is still a difficulty in many of the dry districts. In the former, local labour has always been insufficient and outside labour has always had to be drawn upon. This, outside labour has generally been available, for, men from the dry tracts have come down to the irrigated areas when seasons were unfavourable, or at a time of year when work on the dry land was impossible. But when the irrigation farmer is near a big city, he has always the difficulty of competing with this for the small amount of labour thus obtained.

In the dry tracts where both *kharif* and *rabi* crops can be and are taken, the dearth of labour comes at certain seasons particularly at the times of harvesting the *kharif* crop and sowing the *rabi*. At this time sufficient labour is not available and certain of the operations have to be postponed. For example, in Khandesh, at one and the same period we find the harvesting of *bajri*, the picking of cotton, the harvesting of early *kharif jowars* and dry crop groundnuts going on, while the sowing of wheat and gram have to be done at the same time. In the Mawal, again, we have the harvesting of rice, the cutting of grass, and the sowing of the *rabi* crops going on together. At this time of year the weather is very uncertain and delay in harvesting may mean the loss of a crop, so that a sufficiency of labour is a matter of great importance.

In considering the labour problem we may deal with the following points:—

(1) What can be the reason of the insufficiency of labour felt now-a-days?

(2) Is the present high rate of wages due to the scarcity of labour or to the rise in the price of food, or to both?

The insufficiency of labour at present has been attributed to causes:—

(*a*) The development of manufacturing and other business industries has offered employment at wages which seem to be better than those obtaining in agriculture, even though the *nett* gain to the labourer may not really have been higher. The factories at Bombay, Ahmedabad, Hubli, Sholapur &c., have offered definite hours of work with steady employment and a regular weekly pay. This has caused emigration and has increased the rural rate of wages.

(*b*) The construction of new buildings and new railway and canal works in many parts of Western India has acted in a manner similar to that of the big town factories.

(*c*) Plague and other epidemics have reduced the number of labourers.

(*d*) A general aversion for field work, as more taxing and harder than other forms of employment, has gradually arisen.

So far as the causes of the present high rate of wages are concerned, the following seems to be the condition of things. I have collected data as to the prices of food grains for the last thirteen years, and the rates of wages prevalent in the same years, and the figures are given in the table at the end of the present article. It will be seen that the rates of wages rose suddenly in 1911–12 and 1912–13, and that this followed or accompanied a large rise in the price of food grains. The rates of the staple foods-*bajri* and *jowari*, rose from 12 to 14 seers per rupee to 9 to 10 seers per rupee at this time, and as the rise in wages affected both skilled and unskilled labour we may say that the high wages are chiefly due to dearness of the staple foods. Though the rise in prices was followed in 1914 by a fall, the wages remained at the high figure already reached. This maintenance may, of course, be partly due to increasing scarcity of labour.

The remedies, which can be suggested, on the part of a farmer, to meet the situation, are as follows:—

(1) The extended use of labour saving appliances. The chief difficulty that comes in the way of the adoption of this remedy is the smallness of the holdings but as this difficulty is now universally admitted it is obvious that a way must be found to meet it.

The chief operations on a farm demanding much labour are (*a*) weeding, (*b*) harvesting, (*c*) grass cutting, (*d*) *gul* (crude sugar) making, (*e*) digging fruit orchards, (*f*) cotton picking, (*g*) lifting of certain crops notably groundnuts, onions, turmeric, garlic, sweet potatoes, and potatoes, (*h*) plucking of chillies. We will consider each of these.

(*a*) *Weeding*.–The amount of labour required can be greatly reduced by sowing crops in rows, and with a sufficient distance between the rows to allow cultivation by labour saving implements, instead of the present broadcast and thick sowing. We have many illustrations before the people now of other advantages besides the saving of labour by having lucern, onions, and turmeric sown on ridges, by planting tobacco in rows, and by putting sugarcane in rows wide apart. In Ahmednagar, where cotton is not sown wide apart between the rows, (as is done in Khandesh) we hear a continual cry of insufficient female labour for weeding and the high cost of the operation, a cry, hardly ever heard in Khandesh. I am inclined to think that by sowing most of our crops in rows and wider than is customary, we shall, at once, make a big reduction possible in the labour bill for weeding.

(*b*) *Harvesting*.–As regards harvesting of cereals and grasses, progress is being made in the use of reapers, and crops like fodder *jowars*, grain *jowars*, and grass, can here as elsewhere be cut with reapers and moulders quite well. But the cultivators have not adopted them, as a rule, yet, and there is an urgent necessity for an efficient harvesting implement. Such a reaper, efficient and adopted to our conditions, does not yet appear to be on the market. In the absence of such an implement, one of the existing reapers could be purchased by a whole village or by a single man, for hiring in a village, and this will probably be done gradually in the next few years.

(*c*) *Gul Making*.–At the time of crushing sugarcane, the scarcity of labour is sometimes great. Generally, gangs of workers who are experts at *gul* boiling take the work by contract and go from holding to holding as required. Where this is not the case, the difficulty can be got over (as is being done in a few places) by erecting crushers &c., on co-operative lines in suitable centres.

(*d*) *Digging fruit orchards.*—There are special gangs of men available for digging the beds of fruit trees, and who make a speciality of doing it. The charges demanded now-a-days, however, are rather high. But no labour saving device has yet been found, and the beds must be dug by hand at any rate when the plantation is full grown. A suitable implement would be a great boon. In this matter, the question is not so much the scarcity, as the present dearness of labour.

(*e*) *Cotton picking.*—Scarcity of labour is felt much at the time of cotton picking and if the work is not done exactly at the right time, considerable loss may result. At present no machine is available which will do the work of picking. The work may be done by contract, but then the quality is apt to be spoiled by careless picking,–a point which always deserves to be considered.

(*f*) *The lifting of groundnut.*—This is a very costly process and for want of labour at the proper time, the crop is sometimes damaged. Experience shows that such varieties as Big Japan, and Pondicherry can be harvested better by working a small land-side iron plough than the laborious method of digging, usually resorted to. The method of harvesting country groundnuts, in the Southern Maratha Country, is by working a harrow yoked with four bullocks after the first picking has been done by manual labour. Not much saving in labour is effected by this method and no implement has yet been found which can be used for lifting nuts. In the harvesting of such crops as groundnuts, onions, garlic, and turmeric, no labour saving appliances have yet been devised and the work has to be done by hand.

(*g*) *The plucking of chillies*- has also to be done by hand labour, as no machine has been devised for the purpose.

It will be seen from the above, that as labour is getting scarce, labour saving appliances are coming to the front, but more of such as are suitable to the various crops are required.

(2) *To increase the efficiency of the labour available at present.*—This is a very serious problem, and in fact very little work has been done in this line. The little article in the College Magazine for October 1916 by Mr. Mandke, is worthy of the attention of everybody, wherein the writer has made an attempt to give comparative labour efficiency. To get more efficient work the following things must be taken into consideration :—

(*a*) Minute observation of the individual capacity for work and payment in proportion to the work wherever this is possible. The same rate of daily wages is generally fixed for all and the labourers get equal wages, so there is no encouragement for better work. The worth of the individual labourer should be judged by his work and he should be paid one pice, half an anna or so more than the prevailing daily rate for the day. The object in doing so, is to increase his efficiency for work and to create a sort of competition.

(*b*) Sometimes the efficiency of work is lost by the use of clumsy and ill designed tools. We often see that when we call a number of women for cutting grass, or harvesting a crop, the sickles of all are not well sharpened and neat. They go on doing the work, as they know that at the close of the day's work, never mind how much of it is done, they will get their wages. For this reason, on some of our farms spare hand tools are kept for supply to labourers to get full and efficient work. Many of our implements and tools are not designed to employ the muscles of the body properly so that much of the power is wasted. We might just think of the English shovel and our country *fowada*, both used for filling purposes. The former gives much more efficient work than the latter and also does not tire out the labourer so soon.

(*c*) Bettering the condition of the labourers in general, to attract labour to agriculture from other sources where it goes at present, by illustrating to them the advantages of field labour versus factory life.

It has been already pointed out that a good deal of our village labour, which could have been more useful for agricultural purposes, is attracted to mills and other industries, as they get better wages there. It is quite possible that in the off-season when there is no work in the fields, especially in the dry tract areas, only one man remains at home and the rest go for work outside ; some of this labour will be useful in the irrigated areas to reduce the congestion which occurs there. These village people who go to Bombay and other places contract bad habits of eating and drinking and lose the vigour and health of village life. Generally they show a dislike for field work and become useless for our purposes. In this connection sufficient attraction to them in point of good housing, holidays, and at time recreation will induce them to do agricultural work for which they have a natural liking. They should always be given illustrative talks showing the health and vigour of a villager as compared to a factory returned man. The evil effects on health of work in factories as compared to the free open-air work on field should be shown. The *Holika Sammelan* on the Agricultural College Farm at Poona for labourers is a very good idea and the effects of such at-homes to labourers can be very well seen, inasmuch as some of them show real liking for the institution and thoroughly identify themselves with it with a right kind of spirit.

Good and honest work must be rewarded by increase of wages. Those old days when labour could be easily commanded have gone and we must now try to attract labour as the factories have done by giving them concessions by fixing hours of work. The labourer should be induced to think that his status is raised if he works and sticks to a certain employer permanently. The secret, as to why the labourers in the Kirloskar factory at Kundal Road are attracted to it, lies in the above facts. In this connection, I may just mention a fact from my own experience. In 1905–06, while I was working on the Kirkee Farm there was a family of a Mang labourer working on the farm, an old man with his wife and two sons. All of them were faithful and honest workers. After some days' work the old man wanted to go to his place for the marriage of his elder son. These Mangs are required to give their daily attendances to the village officers. If the man produces a certificate of good character, he is exempted from the roll call. The man came to me while going and asked for a certificate which was given as the man deserved it. The man when he went to his village was exempted from the roll call and thus his status was raised in his own village. The old man after his return told the whole story and continued his work as usual. Some of his other fellowmen were also induced to come and I believe that two of his sons are still working in the *kuran* at Manjri.

It is somtimes said that when a farmer is in a little better condition he does not like to work himself, and if these men would work themselves, the labour supply would be incereased to a certain extent at least. Out of 169 cases of cultivators examined, in an irrigated village, it was found that 122 persons worked themselves, the area under sugarcane in the case of each, varying from one acre to nine acres. In the rest of the 47 cases wherein the men did not actually work, it was found that two men had an area above 20 acres, nine men above 10 acres and it is necessary for the owners of these areas to supervise and arrange the work of such a large area under irrigation. In the remaining thirty six cases five were following other occupations as well as farming, one was doing some farming and some public work ; out of the remaining 30 only five seemed to be really avoiding manual work on their farm. Thus it will be seen that a cultivator when he has some irrigated farming does not altogether idle away his time, as is thought, but does the watering and looks to the general management and business side of farming, marketing &c., which work has to be done by some body.

The source of increasing the existing supply of labour can also be found in the thousands of begging classes who do the business of begging under various pretexts. They idle away their time and are a great nuisance to all and especially to the cultivators whom they rob a good deal. It is necessary that some of these begging classes should be converted into labourers. Some time ago, I wrote an article in the College Mogazine and in the concluding portion I had made a suggestion and an appeal to the social reformers or men engaged in the social uplifting of the country to try and do some effort to convert a batch of the beggars (there are several classes of them and the little book by Mr. Atre viz., Gao-Gada gives a thorough list of these and their habits) into useful workmen as labourers or other skilled workers and thus confer a boon on society as well as on the agriculturists. I would again say that the time has come to make those classes work for themselves for their bread instead of extracting alms by various means from the public.

Prices of Articles of Food in Poona.

Quantity in Seers Per Rupee (By Measure).

	1904–05	1905–06	1906–07	1907–08	1908–09	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17
Jowar ...	17½	12	13½	11	12½	14	14½	11	10½	11	13½	14	14½
Bajri ...	14½	10½	13	11	11	13	13	9	9½	10	11	12	10½
Wheat ...	12½	9	8½	7½	7½	8	9	7½	7	8	7	7½	8½
Rice ...	9½	8½	8	7	7½	8½	9	7	6	6½	7	6½	7
Gram ...	15	11	12	10	9	12½	14½	12½	12	9½	8½	10	11
Tur ...	10	9	8	7	9½	9	10½	9½	7½	7	6	6	7
Gul ...	5½	6	6	5½	5½	5½	5	5½	5½	5½	5	4	5

Rate of Wages Per Day.

	1904-05	1905-06	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17
	Rs. a. p	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Skilled Labour (man)	0 9 0	0 9 0	0 9 0	0 9 0	0 9 0	0 9 0	0 11 9	1 0 0	1 0 0	1 0 0	1 0 0	1 0 0	1 0 0
Ordinary Labour (man)	0 4 0	0 4 5	0 4 0	0 4 0	0 4 0	0 4 0	0 4 11	0 8 0	0 8 0	0 6 10	0 6 10	0 7 0	0 7 0
Agricultural Labour (man)	0 4 0	0 4 5	0 4 0	0 4 0	0 4 0	0 4 0	0 4 11	0 8 0	0 8 0	0 6 10	0 6 10	0 7 0	0 7 0

Rate of Wages Per Month.

	1904-05	1905-06	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17
Permanent Agricultural Labour													
(1) Man ...	...	...	...	8 0 0	8 0 0	8 0 0	8 0 0	9 0 0	9 0 0	9 0 0	10 0 0	11 0 0	12 0 0
(2) Woman	...	...	...	3 0 0	3 0 0	3 0 0	3 0 0	4 0 0	4 0 0	4 0 0	4 0 0	5 0 0	5 0 0
(3) Boy ...	...	...	...	3 0 0	3 0 0	3 0 0	3 0 0	4 0 0	4 0 0	4 0 0	6 0 0	6 0 0	6 0 0

A Note on the Flora of the Sandy Beach between Alibag and Revdanda.

BY

Moses Ezekiel, M. Sc.

* * *

ALIBAG and Revdanda are the first two harbours touched by the ferry steamers running between Bombay and Ratnagiri. From Thal, a village two miles North of Alibag and the most Southern point of Revdanda, runs a beautiful sandy beach, interrupted only by two small creeks, the drier portions of the beach being thickly covered with vegetation.

A study of the vegetation of the beach was made from October to December 1916, and again in September 1917. A careful study of the root and shoot habits was also made and rough diagrams illustrating the root-systems of the non-gramineous plants were drawn, about ten specimens being taken to represent the average.

The following are the plants most commonly found there :--

Malvaceæ	*Sida mysorensis.*
Tiliaceæ	*Corchorus acutangularis.*
Leguminosæ	*Aeschcnomene indica.*
,,	*Alysicarpus rugosus.*
,,	*Desmodium triflorum.*
,,	*Indigofera cordifolia.*
,,	*Crotalaria verucosa.*
Onagraceæ	*Ludwigia parviflora.*
Rubiaceæ	*Spermacoce hispida.*
,,	*Oldenlandia sp.*
Compositæ	*Launea nudicaulis.*
,,	*Launea pinnatifida.*
,,	*Ageratum conyzoides.*
,,	*Vernonia cinera.*
Convolvulaceæ	*Ipomœa biloba.*
,,	*Evolvulus alsinoides.*
Pedaliaceæ	*Pedalium murex.*
Acanthaceæ	*Justicia diffusa*
Verbenaceæ	*Lippia nodiflora.*
,,	*Clerodendron enerme.*

Labiatæ	*Leucas aspera.*
Nyctaginaceæ	*Boerhaavia repens.*
Euphorbiaceæ	*Euphorbia hypericifolia.*
,,	*Euphorbia pilulifera.*
,,	*Phyllanthus sp.*
Pandanaceæ	*Pandanus furcatus.*
Gramineæ	*Andropogon aciculatus.*
,,	*Arundinella Lawii.*
,,	*Digitaria sanguinalis var ciliaris.*
,,	*Eragrostis amabilis.*
,,	*Eragrostis ciliare.*
,,	*Eragrostis tenella.*
,,	*Ischemum ciliane.*
,,	*Oplismenus Burmanni.*
,,	*Paspalum distichum.*
,,	*Perotis latifolia.*
,,	*Saccharum spontaneum.*
,,	*Setaria glauca.*
Cyperaceæ	*Cyperus arenarius.*
,,	*Fimbristylis tetragona.*
,,	*Fimbristylis* various species.
,,	*Rhynchospora vitiana.*

A study of the root and shoot habits of the plants growing in the sand has a high ecological interest and the following are the few brief general statements, that can be made about them :—

Many of these plants, which are also found in other situations far more favourably situated as regards water-supply, and situations less exposed to dessication, and are found to be invariably erect, take to a creeping habit here. Among plants of this category the following deserve special mention :—

Sida mysorensis.
Corchorus acutangularis.
Alysicarpus rugosus.
Spermacoce hispida.

A habit of rooting at the nodes is seen in the following :—

Desmodium triflorum.
Launea pinnatifida.
Ipomœa biloba.
Lippia nodiflora.
Bœrhaavia repens.

In many, the main shoot is generally short and stout and gives off numerous branches which spread themselves along the surface of the soil, and radiate from the root-crown in a fan-like manner, the line joining the apices of the branches forming a semi-circle. The leaves are thick and villous, hispid or tomentose, possess but little sap, and are closely applied to the surface of the soil. The branches and branchlets are covered with a thicker felt of hairs than plants of the same species, growing in a less limiting environment. Among plants showing these characters more strikingly, the following may be mentioned :—

Sida mysorensis.
Alysicarpus rugosus.
Crotalaria verucosa.
Indigofera cordifolia.
Speremacoce hispida.
Evolvulus alsinoides.
Leucas aspera.
Euphorbia pilulifera.
Euphorbia hypericifolia var. parviflora.

Both the Euphorbias show a deep deposit of amthocyanin a habit characteristic of these plants when they grow in situations, exposing them to extreme dessication.

The root system consists of a straight deep tap-root,—with a characteristic thickening at the crown,—dividing into two or more branches after reaching a depth of eight to twelve inches. These branches radiate out in all directions and subsequently bring their tips near each other at the lowest level, so as to have a firm grip on the loose substratum. In a word, the root and shoot habits and the morphological characters of the leaves and branches are those of typical xerophytes.

The following explanation of their xerophytic nature seems to be nearest the truth :—

Sand is a very porous soil and has very little power of retaining moisture in the surface layers. In spite of the heavy rainfall, (an average of 80 inches for the last thirty years) the amount of water available to the plants is small and this has to be obtained from the deeper layers of the soil. The plants therefore adapt themselves to the environment by the production of a deep-seated root-system, which is most extensive in the region of the water-table. The amount of nutriment available in the soil is very small, (though constantly supplemented by leguminous species) most of it being washed away by the first few heavy showers of rain, and hence there is a proportionate economy in shoot production.

Sand is a very loose substratum for a firm hold on the soil, and since the plants are exposed at all times of the year to the strong Western winds, (sometimes North-West, sometimes South-West) and very liable to be uprooted, the spreading of the roots in all directions at the deeper levels and the bringing together of the tips of the root-branches, ensures a firmer hold on the soil than would be possible otherwise.

The shoot assumes an espalier shape, and is thus protected from the tearing and uprooting influences of the high winds that prevail there.

In a word the environment is extremely limiting:—

1. Poverty of water-supply.
2. Poverty of nutriment.
3. Excessive demands on transpiration both on account of the srong winds and the high temperatures of the air and soil.

The plants are exposed to the hot rays of the sun during the day, (there being no shrubs or trees growing there to protect them from the sun by giving shade at some part of the day), and to drought by the strong winds. Sand absorbs heat very quickly and this implies a great demand on the water-supply and the resistivity of the plants in general.

Water is economised by the prevention of excessive transpiration-an object which is aimed at in such adaptations as, (1) a thick cuticle on the leaves, (2) a thick coating of hairs on the stem and leaves, (3) a close intermingling with the shoots of neighbouring plants. The sedges grow in close tufts, packing the soil underneath and forming the advanced guard in the invasion. The grasses make up the rear, growing in situations where the physiological drought is much less acute. *Saccharum spontaneum*, a cousin of sugar-cane, always chooses the more convenient spots where the fresh water pools from the city or village meet the little creeks of salt-water near the shore.

College News and Notes.

WE are glad to welcome Mr. Bhimbhai Desai in his two-fold capacity of Assistant Professor of Dairying and Manager of the Dairy. His arrival delayed as it was, was looked forward to with the greatest interest. We wish him a pleasant and successful time in his new undertaking.

We miss Prof. G. K. Ranade. We hope he will fully benefit by his two months' leave and come back to our midst well refreshed in body and mind, and ready to take up his work with his usual zeal. Needless to say, he has earned this change after his conscientious work as Manager in the Dairy for months. We congratulate Mr. K. M. Pawar on his appointment as acting Assistant Professor in place of Mr. Ranade, and Mr. K. K. Bhatarkar on succeeding him as Acting Superintendent of the College Farm. Need we say how well both the above gentlemen have acquitted themselves?

It gave us much pleasure to see young Mr. A. A. Vasavada, B. Ag. installed on the Farm staff as Assistant Demonstrator. He remained short time, however, as he resigned on securing a more remunerative and responsible position at the Agricultural College at Allahabad. We regret that Prof. G. B. Patwardhan should have had to proceed on leave for three months on account of bad health. We only hope he will return to us fully recovered.

Meanwhile we are happy to see Mr. H. P. Paranjpye, B. Sc., promoted to act as Assistant Professor of Botany.

Mr. G. S. Kulkarni has been appointed as Assistant Professor of Mycology and has shown himself fully equal to his work. We wish him success.

Finally Mr. G. M. Chirmule has returned to us after three months' leave. We all know how worthily he had earned this rest, and in welcoming him back we hope he may spare his health in the future. Mr. Limaye acted in his place most satisfactorily.

The beginning of a new year—for such at least it is for our College,—is usually a happy time. Every man is fired with new hopes and new zeal. If his past has been bright and strong he draws his cheer from it and endeavours to do still better; if on the other hand his past has been strewn with failures and set-backs, he still if he is human—hopes for the best and strives to realise his hopes. For a great many of the new students that have sought the haven of their education in our College the joining this College, must be in a sense a sort of rebirth, and we only hope that the first year of their new life may be crowned with glory.

Life in this Agricultural College is rather different from life in a College of Arts, for although, attending successive hours of lectures may suggest a repetition of the Arts College, there is something radically new in the idea of making your first acquaintance with the bullocks and the harrow. The subjects are many and new and their first fascination is very real indeed. To succeed in this College one must develop to the highest degree the affinity of the brain and one's own good right hand.

There is a certain dignity in the idea of a large number of young men undertaking a new enterprise for the first time, and while bearing the stamp of their individual personality, still at the same time actuated by like hopes and aspirations, and thrown into a healthy rivalry between one another.

It is not a little unfortunate, that while in grave times like these the young men of a country should flock to educational institutions like our College to be moulded into finished Agriculturists—men that will hold in the future the material destinies of their country—and that while students from the far corners of India *are* seeking admission in increasingly large numbers, we should be compelled to refuse admission to so many of them merely for want of room. It almost appears as if the Government by taking from us our main buildings to hospital the wounded, is sacrificing their own interests as well as those of India in this respect rather more from sentiment than from any utilitarian advantage; for, to be losing many a may-be successful Agriculturist—the saviour of his country—among the number of those refused admission, is quite serious enough to challenge the good that is being done at the Deccan War Hospital which for the matter of that could be equally done any where else. And here we venture to think that if the Military Authorities were to commandeer one of the idle mansions of the rich within their bounds, it would be no loss to them, and the country would gain indeed.

Gymkhana Notes.

IN the General Body meeting held last February all except a very few elections took place, and accordingly a continuation of the above meeting took place in June last to complete the remaining elections, as well as to discuss any matters of importance associated with the College activities.

Dr. Mann, who has been the worthy president of these enjoyable meetings the last many years, in opening the proceedings, welcomed the students back to a busy and happy year, and addressed the new-comers especially in those winning words of encouragement that are his own, and which have been spoken every year to bear better and better fruit and whose further charm is that they can bear repetition indefinitely.

The burden of it was that this College is unique in so far as it is the trysting-place of students of all castes and creeds, and races, coming from every corner of India, attracted by the fame of this College. That the every-day life of this College was an example for the world, of the close bond of brotherhood that obtained between students of such diverse birth and up-bringing.

Mr. Gopal V. Hardikar who had been elected Secretary for the Tennis Department, last February submitted his resignation, as he could ill spare any time for his duties as Secretary, being so busily taken up with his work at the Dairy. Mr. Kurtkoti was elected in his place.

Cricket.

The Secretary Mr. Jog is both a player and a man of push and it is to that we owe the active beginnings of this department. Evening practice has become remarkably popular, and the only danger is that it is fast becoming overcrowded. The decision of the Managing Committee allowing our Eleven to compete for the Shield is a happy one indeed and we hope we shall prove ourselves formidable rival competitors.

Tennis.

Enjoying, as it does, a good fund at its disposal, and judging from its present activities it promises to be very successful and inviting; we congratulate ourselves on the able secretary we have in Mr. Kurtkoti.

Foot-ball and Hockey.

It is biding its time. It cannot hope at present to lure players, caught as they are by the fresh charms of Cricket and Tennis, but we have no doubt, that when the time for it arrives, it will quickly snuff out the popularity of the other deparrments.

Debating Society.

A more entertaining literary society we can hardly imagine. Already we have a complete series of lectures arranged, for the first term due to the zeal of Mr. Oza, in his duties.

We are looking forward very much to the opening address, that the Hon. Mr. R. P. Paranjpye is very shortly to give us.

Gymnasium and Swimming.

Swimming is more popular than Gymnastics, and we can understand why; for it combines excellent exercise with frêsh air and water. Still we have some enthusiastic young men that labour diligently in the gymnasium of evenings, bent as they are on having great biceps.

Reviews.

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'The Co-operative Movement' by V. Venkatsubbaiya and V. L. Mehta.

THE book with the above named title has been published by the Servants of India Society some of whose members are prominent and enthusiastic co-operators in the Bombay Presidency. The authors of the present book are directly connected with co-operative work and are hence eminently suited to the task of writing a book based on material obtained by first hand knowledge and actual experience.

The introductory chapter deals with the importance and the advantages of the co-operative movement all over the world and more so in India. Some of these advantages are mentioned in the words of Mr. Wolff, the greatest living English authority on co operation as follows :—"The idle man becomes industrious, the spendthrift thrifty, the drunkard reforms his ways and becomes sober, the haunter of taverns forsakes his inn, the illiterate though a grandfather learns to read and write."

It is pointed out, however, that the mustard-seed of co-operation has been sown in Indian soil and the plant is being watered, mainly by official hands, though some of the Indian leaders have also shown much keenness in their assistance to co-operation. The scope of work and the aims and objects of a co-operative society form the topic of the second chapter. The co-operative movement includes all those forms of voluntary association where individuals unite for the production of wealth, which they would devote to common purposes or share among them upon principles of equity, reason and the common good, agreed upon beforehand. It has been shown to be the opposite of competition, its motto being 'each for all and all for each'. It is not a charity but a business organisation. The scope of co-operation is nearly as wide as that of economic life itself, ranging over the entire field of production, distribution and consumption of wealth.

The chapter dealing with the progress of co-operative movement in European countries forms very interesting reading. The progress of the movement in England, Germany, Denmark and Ireland is described in a clear and succinct manner, and the first part ends with the chapter on the history and progress of the co-operative movement in India. It is shown that for the present, only one per cent of the population has been touched by co-operation. Still there are some satisfactory indications of its influence apart from the actual formation of societies. For instance, the general rate of interest for agriculturists has appreciably gone down. The hidden wealth, in some places at least, has found its way to the societies as deposits and become productive. Unproductive expenditure has been curtailed in some places. A beginning has been made in intercepting the profits of the middlemen. The effect of co-operation on litigation is seen in a few centres. Education has received a general impetus.

The second part deals in detail with the agricultural and the non-agricultural credit societies, bringing out clearly the differences in the scope of their activities, and in their management. Their present position in India has been well shown with the help of recent statistics.

One chapter is devoted to the consideration of non-credit co-operation. This branch has not received attention and support from the public to the same extent as credit co-operation, though it has a wide range of activities. Bombay stands first in the progress of this branch of co-operation, though in other branches other provinces have taken the lead.

The importance and the utility of central societies and central banks are shown in two separate chapters.

The question of state-aid and control is discussed at length. Valuable suggestions are made with regard to organisation, supervision, and audit of the societies, in the concluding chapter.

Such are the salient features of the book under review, and on the whole the book provides interesting as well as stimulative reading and is a valuable addition to co-operative literature in India. All persons interested in this movement would find this book of great use and help.

'*Domestic milk products' by B. K. Ghare, L. Ag.*

We have great pleasure in recommending to our Marathi readers 'घरगुती दूधदुभतें' this little book of forty-eight pages. The author had previously published two larger books on the same subject which were welcomed by the public with warm appreciation. The present book is an attempt to meet the growing demand for an elementary book on the subject of milk and milk-products, and it forms interesting reading, even to a layman, from beginning to end.

The author has dealt in a popular style with the subject of the production of milk, its important ingredients, and the comparative values of the milk obtained from different animals. The principles of sanitation and hygiene, that are to be observed in dealing with milk and its products are clearly explained. Useful hints for the treatment and the care of domestic animals have been given in a separate chapter.

We have no hesitation in recommending this book on such an important subject written in a popular style avoiding all the technical difficult terms which generally frighten the common readers.

' *The Business World'-A monthly Magazine published by H. Dutt, Calcutta.*

We feel great pleasure in welcoming "The Business World" a monthly magazine devoted to different industries of the world. The Magazine is edited by Messrs. K. S. Sirkar and H. N. Banerjee both of whom have a wide experience in journalism. Under the guidance of these editors we hope that the magazine would prove of great service to the people by providing them with useful and practical information on matters of technology, manufacturing arts and industries. We wish every success to our new contemporary.

Short notes on New Books in the College Library.

Concrete Silos.-by Hanson.

A very useful book as it gives much information suitable to our conditions. A good book for those interested in Animal Husbandry.

'Determination of Farming Costs' by Orwin.

A very useful book since it gives very clearly as to how accounts on farms should be kept, so that a farmer may fully understand which of his products pays him, and which not.

'The Potato' by Gilbert.

A student interested in Potato cultivation' will find this book very valuable.

'The Farmers' Guide Book' by Palmer.

A very suggestive book to a practical farmer.

'Practical School and Home Gardens' by Hood.

Gives ideas as regards management of home gardening especially as regards rotation and the supply of vegetables.

'Effects of One Crop upon Another and upon the Fertility of Soil'

by S. G. Mutkekar.

This is the thesis for the degree of M. Sc., of the Massachusetts University of one of the old students of this college. It shows very great industry and capacity for research.

'Agricultural Economics' by Nourse.

A very useful book for all our senior students.

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EDITORIAL.

OUR AGRICULTURAL STRENGTH AND POSSIBILITIES.

IN one of the numbers of "Physical Culture," we have come across a very expressive illustration of the relative importance of the vast and various resources of the United States of America to one another. It is the figure of Uncle Sam. His right arm powerful and muscular, represents the fighting forces of America. His left arm, crippled and emaciated, expresses the painfully large number of the "physically unfit." His right leg, a very pillar of strength, stands for the agricultural strength of the country, with its inexhaustible mine of food products. His left leg measures the industrial strength of the country and so on.

Now, if we in India were to graphically compare by a similar illustration, our own resources, how would they speak for themselves? Certainly a broad and sturdy chest and a full and knotty right arm would barely signify the man-power of India, and yet both of them would be stiff and paralysed.

Two whole legs would denote our agricultural strength, but to be correct they would be feeble and rickety.

Now, this is enough to flash on our minds, our present agricultural situation, in its relation to the world-war. Much as has been written and spoken on the stupendous responsibility of India, of meeting the titanic demands for the food products of the field, from our heroic armies at the front, we feel it will bear much more still, for what we may have achieved so far, is as nothing to what we ought to and might have achieved, to this end.

In a competition of this nature and one which is a life-and death struggle against time itself the most urgent problem must certainly be, how best to meet these enormous demands in the shortest space of time with the best returns.

To our way of thinking, it would not only be pardonable but even proper to stint neither brains nor muscle and nerve, neither money nor labour to force the maximum crops by exploiting and even exhausting the land, in a crisis such as we are facing to-day.

But here the dearth for efficient labour becomes imminently meaning. As we have noticed in our last Editorial, while incidently touching the question of the efficiency of Indian labour, the Indian labourer threatens to become almost the "limiting factor" in the success of Indian agriculture.

A foreigner, but more particularly a westerner, needs not to look for very long upon Indian life in the village or in the field, to form very naturally but quite impartially a vague but broad impression of extreme poverty associated with certain easy ways and habits of life of the simple unschooled occupants.

The people do not seem to reckon with any such factor as time in their lives. The Indian villager, whether sole proprietor of, or as a labourer on, his little estate has no quarrel with "time".

Let time sweep on her endless march ; he will catch at her fleeing skirts and tug jerkilly to delay her, he will not hold her up by the "fore-lock". And so time brushes past ; likewise his profits.

The Western Agriculturist, on the other hand, may be seen to dispute every step of Time's march and get things done, in anticipation of her resistless coming. Some Western observers have remarked that the Indian's idea of happiness is summed-up not in the one word "prosperity" nor in the word "home" so much as in the small inpretentious word " ease ".

The poorest man will sit with a little *"bidi"* in his mouth or with empty hands folded in placid repose, gazing straight before him, but seeing nothing and lost in reverie. Thus, while he is at his ease he is completely at it, but while he is hardly so through. It may be his own land but his heart is only half in it, and his work is as a result long-drawn-out crude, and slipshod. One has only to recall the extreme primitiveness of the tools of the Indian husbandman to bear this out.

But, we ask, shall we blame the Indian"ryot" for his inefficiency? Hardly. He is the result of many generations of cramping poverty in the land. The cold hand of want and woe has lain heavily upon him, from the time of his remote ancestors. All through his long uneventful history may be seen the humble figure of the husbandman groaning under the heels of the Money Lender.

His whole evolution has been shaped by the most damping vicissitudes of life. One long uninterrupted tale of want and hardship and injustice, shall we wonder that he has not that development of body and mind, the flow of spirits that makes for the highest efficiency of hand and brain?

It partly remains with us to improve his lot. He needs to be better paid and less abused. He needs to be trained in the simple rudiments of the most economic ways of handling implements and tilling the soil generally, from the point-of-view of time and efficiency.

The labourer who is thus an advance over his mechanical go-by-rote brethren, will be the pioneer of progressive agriculture in the land. Every department of the farm may be brought up-to-date in vain, if the labourer's lot and his no-methods of work, are not reformed as a first step.

And yet, having produced quick harvest after quick harvest, it still wants the utmost efficiency and despatch before the finished product can reach the man-in-the trench. The latter presupposes a faultless organization for shipping, packing and tinning etc. which is more than may be expected of the agriculturist.

Upto this point then, we have seen what our shortcomings are and what our capacities. We cannot get beyond the fact that we are mortal and the final issues and the greatest, rest not with mortals. We refer to the great cry for rain that suffering man has raised all over India from time to time. This time all the land of middle India has raised a wail of woe such as might well pierce through the cloudless skies.

The soil has shrunk and gaped in its dry agony. Little seeds and seedlings by the countless millions have roused the little lives within them in the promise of joy, only to die fitfully in the bosom of their famished mother; and man groans under the dark cloud of death that looms over lands, lit up by the sun's bright glory.

It makes one gravely thoughtful in these dark days to contemplate the lot of humanity. The Great War is steadily claiming its harrowing toll of misery, and the world seems to be steeped into chastisement for the moulding of a new humanity.

A Climbing Mango in the Deccan.

BY

G. B. Patwardhan, B. Sc.,

Assistant Professor of Botany.

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LAST autumn I paid several visits to the firm of Messrs. Bendre & Co., Sadashiv Peth, Poona City, for the purpose of advising on the cultivation of grape vine and some other fruit trees growing in their compound. During one of these visits, I happened to notice a mango tree growing in their court-yard which presented certain features of interest.

An enquiry regarding the life history of the tree previous to my notice of it elicited, the following information from its owners.

The tree is an *Alphonso* graft bought from a local *mali*, Maruti *mali* of Nagarkar's garden, Poona, for Rs. 3. The region of union of stock and scion is not visible now as it is concealed under the surface of the soil, being planted deep, but the owner assured me of his having had noticed its presence at the time of purchase. It was growing in a pot before transplanting in the ground in July 1912. Its height was six feet and girth of stem at the base was about one and a half inches. It was reputed to be three years old when planted. The thickness of the stem was uniform from top to bottom. The stem presented one bend near the base which is still well seen in the illustration. Since planting there, it had been supported by tying to a vertical post driven into the ground. Whenever the stake happened to fall down on account of rotting at the bottom, it was replaced by another. Until the rainy season of 1916, the tree remained so supported, when the strong support was again uprooted, not by rotting this time, but by the lateral pull of the tree. In consequence the tree toppled over to the east. It was then tied in position by means of three tent ropes to neighbouring trees or to posts on the verandah of the house. The tree yielded six fruits for the first time in 1916, that is to say, four years after planting. In the year 1917, about forty fruits were collected twelve of which had the normal size of past year's fruits while the rest were smaller. All the fruits of 1917 presented a dark coloured band on the inside of

'A Creeping Mango.'

the skin, the band penetrated a little into the pulp beneath also. The nature of this dark discolouration was not investigated. The flavour of the ripe fruit was said to resemble somewhat that of *Alphonso*. I had no occasion to see the fruit of 1917 crop myself.

The tree had all along presented the peculiar tendency to fall down to the ground ; it refuses to stand erect unless very securely tied to a strong stake. The zig-zag stem noticeable so clearly in the illustration may be result of two forces—a horizontal one due to the binding to an erect support and the other the inherent inclination of the plant to trail down, both forces acting on a plastic axis ; it is impossible, of course, to express in exact mathematical terms the nature, magnitude and direction of forces acting on the stem resulting in the zig-zag form assumed by the stem. The branches are long and slender. The branches and the stem both have a fairly uniform thickness from base to top. The branch tied to a string on the left (see illustration) falls down to the ground, if released and the tree inclines to the west if the ropes are cut away. All the smaller branches have a decidedly drooping tendency. On the whole the tree presents little resemblance to the common *Alphonso* tree which is erect though not gracefully symmetrical. On the other hand it presents no clear indications of tendrils of any sort. Still its characters such as (1) the uniform thickness of stem or branches throughout their whole length, (2) their drooping nature, and (3) the zig-zag main stem, lend support to the view that it is a weak stemmed plant probably in a stage of evolution to a climbing habit. In Watt's Dictionary of Economic Products Vol. V page 152 reference is given to two types of mango of *Lutea* class "which were originally staked and trained down to the ground and bore fruit in this way. After considerable space was thus covered, eventually the training ceased and the trees at once grew up and formed straight stems." The individual of our illustration though six years in the ground has not yet assumed an erect posture but instead presents curved and decumbent branches. It may be considered as a graft-sport.

From an horticultural point of view it may be of much interest to examine the proximate environments of the tree and see if the latter have not in any way contributed to the development of the characters in the tree.

It is growing in a quadrangle formed by residential rooms and the petty workshop of an engraver who works without any elaborate power-driven machinery. The buildings are eight to eleven feet high in front, with a dwarf second story about five feet higher, located backwards farther away from the quadrangle. The western wall is thirty five feet away from the tree, that to the south ten feet, the one to the east about fifty feet and the one to the north about seventy feet. The tree itself is about eighteen feet high. A couple of custard apple trees are growing in a line at a distance of ten feet from the tree at the south east. These trees are assuredly younger than the mango. One betelnut tree shorter than the mango is visible in the photograph. Thus there is nothing like shade or overcrowding or anything else that might have been possibly taken to account for the peculiarity in the stem of the tree.

The tree fruited very well this season (June 1918). The fruits were examined by me. The shape approximates to that of *Alphonso* ; the fruit is smaller and the surface of the skin is not quite like an *Alphonso*—smooth and tender looking. On cutting a slice one can easily peel off the very skin like a banana fruit. The flesh is very delicious and free from fibre. The stone is of moderate size. On the whole, the variety possesses good and desirable characters. The following description of the fruit was supplied by Mr. S. H. Prayag of the Ganeshkhind Botanical Garden, Kirkee.

Weight.—139 grammes ; *dimnesions* 7 x 4·5 x 5·5 centimeters ;

Surface—green to yellow with reddish tinge on the shoulders ;

Glands—yellow, minute and inconspicuous ; *beak*, almost imperceptable ; *left shoulder*, higher than the right ; *skin*, thin ; flesh, pale yellow with orange colour in the middle, delicious acid taste or piquant juicy, more like *pairi* than *alphonso* ;

Stone—weighing 19 grammes, *size* 6·5 x 3 x 2 centimeters.

Methods for Bringing the Agricultural Improvements to the Notice and into the Practice of Cultivators.

[*A paper read before the Agricultural Conference,*
by V. G. Gokhale, L. Ag.,
Deputy Director of Agriculture, Konkan, in April 1918].

THE dissemination of agricultural improvement forms a very important section of the work of the Agricultural Department. For whatever results may be achieved by the experimental and research work are practically of no avail unless suitable steps are taken to make known such results and have them adopted in actual practice by those who are to benefit by them. My intention in bringing up this question before this conference is to fix certain ideas on the subject which would guide us in carrying out our work in this branch.

The following may be said to be the principal aspects of the subject :—

1. Objects or items of demonstration.
2. People to whom demonstrations are to be made.
3. Methods of dissemination.
4. The agency for dissemination.

Objects or items of demonstration.—No one will question that it is essential that any new knowledge to be disseminated must first be very thoroughly proved to be of a distinct advantage over the existing practice and to be within the power of the people who are to adopt it. If such definite knowledge is not available or the applicability to a certain tract has not been convincingly investigated, it is better to stop all propagandist operations until some definite basis of fact has been attained, by concentrating on experimental work. More harm than good is done to the work by trying to push imperfect things, the possible applicability of which has not been determined by a close study of the local conditions.

Granting the above proviso, it would be then desirable to confine the work in the beginning to the most striking and convincing improvements. Once the confidence of the people is thus secured, minor things will not be difficult to introduce gradually as a matter of course.

Choice of people to whom demonstrations should be made.—The best persons to approach for a start are those whose main occupation is agriculture, and who are sufficiently capable and interested faithfully to follow instructions. It is often alleged that an Indian cultivator is too conservative, and is slow in adopting improvements. But this is not the case. Owing to his ignorance and even more for the treatment he has been accustomed to receive at the hands of Government officials in general in the past, it strikes him as very strange that Government should offer something for nothing--and without being asked. He therefore suspects that there must be some motive at the bottom of all this, such as the enhancing the land revenue or some such thing. But if by persistent efforts, example, sympathy, ability on the part of demonstrators to meet the farmers on their own ground and to convey practical instructions in a convicing way, this false notion is removed in course of time, and his confidence secured, the Indian farmer is as ready to adopt improvements as any other. In most parts of the Konkan the system of land-lords and tenants again presents a certain difficulty for rapid work. The land-owner is not interested further than to reap his share of the harvest. He is not anxious to press his tenants to change his methods for fear of discontent. The renter is too poor to experiment, or to invest any capital. Besides he also fears that his rent will be increased by the land-owner if by adopting improvements the outturn from the land is increased. But even in such cases, really useful, strikingly profitable improvements, are adopted if brought to the notice of the tenants, such as the procuring of the proper seed, implements or manures, or the disposal of the produce specially of a new crop, to the best advantage.

Methods of dissemination.—Passing from these preliminary considerations to the most important aspect of the question namely, the methods of introducing the improvements, the several methods that have been so far used in this division or elsewhere may be epitomised under the following heads :—

1. **Local demonstrations, so that the items demonstrated shall be within the frequent sight and scrutiny of cultivators.**
2. **Demonstrations at a central place such as a Government farm.**
3. **Lectures and talks.**
4. **Publications.**
5. **Awarding of prizes at agricultural exhibitions and,**

6. School gardens and agricultural schools.

Out of all these the first is undoubtedly the most effective. These demonstrations must be as near the homes of the farmers as possible where they can have a chance constantly to observe, scrutinise, compare, and contrast, the improvements with their own methods, and decide for themselves as to their suitability to their own conditions. This method is the only one which will appeal to the uneducated farmers who form a large majority in this country ; conviction carried in this way is of very great service in winning the confidence of the cultivators, and when the confidence is thus once secured, other methods of dissemination will begin to operate.

In order that such local demonstrations should produce quick and permanent effects with the least possible energy spent, it is very essential that the demonstrations should be persistently followed for a sufficiently long period at anyone place where it is begun, until the results are so well impressed that at least one cultivator, on whose plot the demonstration is given, will permanently adopt it as his usual practice. The centre is sure to act as a nucleus of the spread of that improvement in the surroundings.

The other method in the present stage of intellectual incapacity to grasp what is not actually seen continuously by the eyes, and until there has been a creation of confidence amongst the people that the Agricultural Department really have something valuable to teach them, must remain of a very minor and secondary utility. They are chiefly, in fact, a preliminary to arouse interest, and supplement and strengthen the effects produced by demonstrations.

Talks, lectures and uncalled-for advice are of little avail except in the case of the extremely few who are intelligent and enterprising enough to give a trial to what is said to them in such talks. Lectures are only useful when accompanied with demonstration plots. A heart to heart talk with ten or fifteen people in the field where they are working accomplishes infinitely more than a lecture before two hundred people in a town hall. It is practically an impossibility to induce a cultivator to change his methods by talking to him, no matter how convincing the arguments and how promising the returns, he must first see it with his own eyes. Even then, it may be necessary to repeat a second and a third time in order to remove any doubt that may still be in his mind. Such a condition as this can only be overcome by a demonstration of the fact provided, which is best done by means of a plot maintained on the land itself. Once however the people become convinced by means of demonstrations that whatever is recommended proves valuable in actual practice, they will begin to place confidence in what will be told to them by way of talks and lectures, and will be prepared to give a trial to suggestions thus made.

Bringing parties of cultivators to the farms or central places like the exhibitions similarly bring about very poor results which are quite incommensurate with the time, money and energy spent on such demonstrations. The visitors think that whatever results they see on the Government farms must have been obtained by enormous expenditure or be due to special facilities of ready capital and labour at the command of Government and though thev actually see particular results with their own eyes they are not satisfied that their own conditions of soil, climate, capital, and labour would yield similar good results, and therefore are not prepared to take the risk.

The results from publication can be classed under the same category as those of talks and lectures. Nevertheless publication is an essential factor of any propaganda work since it leaves a permanent record, is the cheapest means of communicating knowledge to those who definitely ask for it or for making the experience of one generation useful to another.

The method of awarding prizes would be useful as a supplementary way of stimulating the spread of improvements, provided the spade work is first done by demonstrations. The present way of awarding prizes at the exhibitions is not the right one to stimulate deliberate efforts to make and bring about or adopt improvements. The prizes are small and mostly given away to only the best products which are usually the fruit of natural conditions, rather than substantial sums to the products of special efforts. It is time now that this system of awarding prizes should be stopped and a more rational way of awarding valuable prizes to genuine efforts at definite improvements.

So far the methods described are mostly to approach the adult farmers. The effects produced by catching the farmer younger are bound to be of greater consequence. The system of attaching school gardens to the rural schools and establishing agricultural schools are calculated to produce good results. This has not received its due and legitimate share in India. In Ceylon they are reported to have been successful. New crops or methods can be easily introduced through this medium much faster than through any other. Whatever new things have proved successful in these school gardens cannot but crawl into the local agricultural system. The school gardens and agricultural schools, apart from many other benefits, will make the minds of the school children--the prospective farmers--more receptive and sympathetic towards anything that will be told and demonstrated to them. This phase of this subject does not seem to have been recognised in the several discussions that have so far taken place on the subject of rural education. It is high time that this method should no longer be neglected.

Once a theme has, by one or more of the above means, been brought to the notice of cultivators to their conviction, the spread of the improvements may be effected by means of hire and sale depots for implements and appliances and supply of manure, seed and the like.

Agency for the Dissemination of Improvements.– We come finally to the last, but by no means the least important requirement for bringing agricultural improvements to the notice and into the practice of cultivators namely, the most adequate agency for the purpose. Usually two seem to be employed and possible. These are (1) the direct agency of Government and (2) private agency either through individuals or bodies of individuals. Whatever agency may be employed, it is essential to have some one charged with a definite function of going round from place to place and demonstrating. We will call him a demonstrator. It will not be out of place if I mention here the requisite qualifications of a demonstrator and the manner of conducting the demostrations in order to make most of the available resources.

First with regard to the demonstrator, the essentials are best stated in the American Year Book of Agrlculture for 1915 as follows:- "Understanding of the real problems of the region, sympathy with the people, ability to meet them on their own ground and to convey practical instruction in a convincing way, studious inclinations and habits and business ability of a high order."

Men with agricultural training are necessrry; they must be well grounded in the principles of agriculture and of good personal appearance. It takes certain time to overcome a certain timidity. The instructor is likely to feel that the farmers are hard to approach while the farmers feel that the teacher does not know what he is talking about. In the beginning a demonstrator must be trained and before he is given any independent charge he must have an opportunity to work with an experienced demonstrator. The first assignments of his duty should be with the best organised and most prosperous project. Outlining the work from time to time and frequent inspection of the work being carried out are necessary so that the man may not get unenergetic and follow the line of least resistance.

If it is intended that the energies of the demonstrator should be utilised to the best advantage to himself and the people it is imperative that the sphere of his activities must not be too large. Thus a lot of time which would otherwise be used in travelling could be employed in doing actual effective work and yet not unnecessarily wear out the man. A demonstrator with a large jurisdiction never becomes thoroughly acquainted with the territory or the people, and, because he is unable to accomplish what is expected and required of him, he loses ambition in the work. It is far better to have a small managable block intensively demonstrated than a large one partially. When the work is intensively carried on, the adoption of teaching is much quicker and more universal, more people are reached and the results much more marked. Further more, such a change needs less attention after a certain period of working so that the territory covered can be gradually extended as the people gain confidence in the demonstrator.

There is a loss of efficiency due to frequent changes in the workers and although some changes are unavoidable and often for the good of the service, they should be as few as possible.

Wherever the demonstration involves new practices or the cultivation of new crops the demonstrator ought to be given an actual worker or *kamdar* as he is termed in the Central Provinces who will carry out the actual processes on the fields of the cultivators who would be selected. For instance if onion or lucerne cultivation is to be introduced in a place where it is quite new, the *kamdar* should attend to all the details of cultivation for the cultivator, until the latter understands the new methods. If the cultivator is simply left with instructions he will invariably follow his old methods so that each and every operation must be done by the help of the *kamdar*. In the Central Provinces for demonstrating rice transplanting one *kamdar* is in charge of two villages, five such *kamdars* (or a territory of only ten villages) forming a charge of one demonstrator or an agricultural assistant as he is called there. Whatever agency is employed to carry on the demonstration it is quite incumbent that the direction, guidance and supervision must be vested in agricultural experts, and under the present conditions it is only the agricultural department of Government who possess such experts and is therefore the most competent to carry on the propaganda work.

There are however other agencies of a private nature that can be and are utilised for the purpose of dissemination. Such local bodies, formed as they should be, out of the people themselves, ought to be able to help considerably in carrying on the dissemination work. We would, however, examine how far they have been so. There are specially organised bodies for this purpose, under the title of Agricultural Associations. Such have been in existence in Konkan for the past five years. For one reason or the other however they have not been very effective. The main reason is generally the lack of sufficient public spirit and want of faith on the part of members in concerted deliberation and action. Most of the present members have no direct interest in the land, while, those who are the actual cultivators are too ignorant to understand the benefits from such bodies. It may be that those local bodies not being legally constituted, do not carry as much status as other local bodies such as Co-operative Societies or Local Boards and have not therefore been able to stimulate enthusiasm for work. Besides, agricultural associations have to call for regular annual subscription for which the members do not see an adequate return immediately and individually. It seems that increasing their status by due recognition and granting of certain substantial concessions in the way of certain exemptions, as is done in the case of Co-operative Societies, or supplying a demonstrator at Government cost, may produce better results.

A question was brought forward in the last session of the Board of Agriculture whether Local Boards cannot be utilised for the dissemination work, but they must have the services of a paid demonstrator whose work must be laid out, guided, and inspected by the Agricultural Department. Thus the *role*, the Local Boards would play, would be only in the provision of funds, if they have any, just as in the case of primary education.

There is one more very convenient agency for introducing improvements among the cultivators which must not be lost sight of. It is that of Co-operative Societies. Those bodies owing to their being able to provide for the over important need of money, will necessarily command the confidence of the members whom it will not be so difficult to induce to try the improvements that may be explained to them. Moreover, if the improvements involve the necessity for capital, the Co-operative Societies will be in a position to afford the best help possible. But even with these, some one having technical knowledge, is necessary to give the necessary demonstrations and advice.

Potato Cultivation in Western India.

BY

Dr. H. H. Mann, D. Sc.,

Principal, Agricultural College Poona.

[A paper read at the Opening ceremony of Potato Works of the Union Agency on the 8th August 1918.]

IT is, and has always been astonishing to me that the cultivation of potatoes in Western India has not extended more widely than it has hitherto done. Potatoes were introduced as a crop more than eighty years ago in the northern part of the Poona district, and have been grown there ever since, the average area in this district for the last twenty years having been about five thousand acres. Elsewhere they are grown, and grown with great profit, the potato cultivation near Belgaum being, for instance about as intense a form of culture as there is on this side of India, but the area there and elsewhere is very small. The total land under potatoes, in fact, in the territories under the Government of Bombay does not exceed about eight thousand acres.

The area thus remains small in spite of the fact that two crops of potatoes can be and are grown in the year, that, as we have proved, the yield, which can be obtained at least in the cold weather, is high, that potatoes are dear and hence a good price can be obtained for the produce, and that varieties have been found which stand our conditions exceedingly well. But its cultivation nevertheless presents great difficulties, and while it is very popular as a crop among the cultivators in the districts where it is grown, its extension is slow, if indeed any extension at all has taken place during the last twenty years.

The difficulties which have beset the cultivation of potatoes in Poona district, taking this latter as typical of a large part of Western India, have been chiefly with regard to three or four things, as follows:—

(1) There has been great difficulty in maintaining the quality of the seed potatoes used, leading to the necessity of annually importing large quantities of seed from Italy.

(2) There has been great difficulty owing to certain diseases of the growing plant, notably the so-called "ring disease" and the "*rhizoctonia.*"

(3) There has been great difficulty in storage of potatoes largely owing to the prevalence of the potato moth, and to certain forms of rot which appear when potatoes are stored at high temperature.

(4) There has been great difficulty owing to the yield being relatively small (at least in the rainy season) as compared with that obtained in Europe.

Now it is obvious that an extension of potato cultivation will benefit the country, and lead to an increase in the food supply, and moreover, that if these difficulties could be got over, the cultivation of this crop would be very much more remunerative to the cultivators. Experiments have therefore been made at intervals during many years by the Agricultural Department and others to deal with these difficulties. The war and the stoppage of imports of seed potatoes from Italy made the whole question an urgent one, if the cultivation of the crop was not to diminish rapidly, and in conjunction with the Union Agency, Ltd. of Bombay, and some members of the staff of the Agricultural Department the matter has been taken up within the last eighteen months. This has been done in such a way, as partly at any rate, to solve these questions, to enable the Union Agency to put on the market seed of good quality acclimatised to local condition, to get rid on a large scale of the greatest difficulty in storage, namely the potato moth, and to provide manures which can profitably be used to increase the yield to a considerable extent.

The Potato Works to be opened to-day carry out largely what has been found out, and the exhibits illustrate moreover what can be done further.

Method of Securing Good Quality.

It has been the common custom in the Deccan districts to belive that at least every three or four years fresh Italian seed potatoes must be obtained if the yield of potatoes is to be maintained. This is not universally held, and there are cultivators who have used their own seed for a good many years and still get excellent yields according to the standard prevailing here. I am, in fact, inclined to believe, from our experience in the potato districts, that the loss in yield by using local seed is due to disease, chiefly *ring disease*, in the seed, and to lack of germination in the seed potatoes due either to their not being ripe enough or to the eyes having been damaged by potato moth.

If this is the case, it becomes of the first importance, more especially since Italian seed is not now obtainable, to secure the purest possible seed, to get rid of the potato moth by fumigation, and remove, so far as possible, any diseased tubers which exist before the seed is sold for planting.

These operations are now part of the regular practice of the Union Agency, and their methods are illustrated in the exhibits shown.

The seed is obtained from fields selected as being almost or entirely free from disease, and this can, of course, only be secured by those who know our potato districts very well. There are villages, however, near Peth in the Khed *taluka* of the Poona district where the crops grown are remarkably healthy, and where seed very free from disease can be obtained.

On being brought to Poona, such seed is at once fumigated by means of petrol vapour, in large fumigating chambers, shown on the potato works, each of which holds three tons of potatoes. The bags remain in the fumigation chamber for twenty-four hours, and the moths and their caterpillars are all killed. The pupa of the moth is not always killed, but it very rarely gives a moth, and the eggs, though not entirely killed, do not cause much trouble if the potatoes are fumigated within a fortnight after reaping the potatoes.

After fumigation, the potatoes are very carefully sorted by a series of women who have become extremely expert at this sort of work. Four types of disease are removed when found. Of these the most dangerous in seed potatoes is the *ring disease* of which more later. The detection of this disease without cutting the potato requires very great practice. *Rhizoctonia* is also found, but the variety of this disease common here can be fairly detected. The third disease found and removed is the so-called *Devi*, caused by an eelworm, while the dry and wet rots of the tuber caused chiefly (directly or indirectly) by *Fusarium* fungus are also taken out.

When the seed is for sale, a final selection is done by one of the specially trained experts of the Union Agency, and when a guarantee is required I go over a sample taken from every tenth bag, and judge the amount of disease in the seed supplied from this sample.

If the seed is taken from a healthy field, and if all the above operations have been carried out, there should be a negligible quantity of disease left in the seed.

Ring Disease of Potato.

One of the most serious diseases of potato in our districts, the presence of which has caused the continual call for Italian seed, is that known as the *ring disease.* It is shown in the exhibits. It causes the death of a large proportion of plants in the field, and a large number by rotting in the storehouse, besides lowering the market value of every sample of potatoes in which it is present. Its presence is shown by a ring of brown matter inside the tuber itself.

We have proved during the last year that it is almost entirely carried by infected seed, and though it can and does very often infect the soil, yet the infection would soon die out (generally in six months) if fresh diseased seed were not planted. At present, however, it is often responsible for the death of no less than forty per cent of the plants in many fields in the north of the Poona district. Pure disease-free seed is the remedy for this, and this can now be obtained if the methods indicated above are carried out.

Rhizoctonia Disease of Potato.

This disease, extremely serious in the crop grown in the rainy season, seems almost entirely due to infection from the soil in which the potato is grown,—when that soil is wet, insufficiently drained, and badly ærated. It may also be caused by the seed potatoes, though here in the Deccan this seems to be a minor method of infection.

Devi Disease of Potato.

This disease characterised by a shining, but lumpy surface or the potato, is caused, as already stated, by an eelworm and is not of so great importance in the field, though it makes the storage of the potatoes difficult. We have not yet fully studied the method by which this disease is carried.

Fusarium Disease.

This disease, which seems to cause the greater part of the rotting of the potatoes in storage is, as we have proved, carried by the seed, and a crop grown from potatoes affected with it will be very largely affected with it. It is hence very important that tubers affected with it should be eliminated from the seed. It consists generally in the first instance of a small patch of dry rot in the tubers, but this is very often followed by the invasion of other organisms, chiefly bacteria, which convert the potato into a wet rotting mass. Examples of the disease in all these stages are shown.

So far, therefore, as these diseases are carried by seed, an effort is made to eliminate them, and though it is not claimed as yet that all diseased potatoes can be removed by this means, nearly all can certainly be taken away, and so the yield of the next crop can be very largely increased.

Within a year or two, it is hoped that a further step will be taken. Starting from absolutely disease-free seed, which we have now obtained, we are arranging to produce a gradually increasing amount of seed potatoes, whose history for several generations is entirely known. In this we are having the hearty co-operation of the people in the potato growing districts, and with their help it ought to be possible to hold the 'ring disease' and the other diseases in check in the future.

Storage Difficulties.

But the diseases of growing plant are not by any means the only difficulties of the potato growers. They themselves put the potato moth in the forefront of their troubles. This, which appeared in Western India soon after the first importation of Italian potatoes, lays the eggs on every exposed potato, either during growth, or after they have been lifted from the field. These eggs are laid in the eyes of the tubers, rapidly hatch out, and the caterpillar, after eating the eye bud (and so making the potato useless for seed), enters the flesh of the potato and rapidly converts it into a mass of rottenness. I have seen eighty per cent. of the potatoes in a storage heap rendered useless either for sowing or for sale by this enemy.

The moth in every stage is shown at the potato works, and its effect on the tuber.

Luckily it has been discovered that the moth and caterpillars can both be killed by fumigation with petrol vapour, and this forms now a regular practice in these works and a fumigator will also during the next year be established in several of the leading villages of the Poona potato tract. This fumigation is not absolutely fatal to the eggs of the moth or to the pupa, but the latter is very seriously weakened by the treatment, and the former can be very largely eliminated by choosing the time (after lifting) when the fumigation takes place. It is recognised, however, that to secure the entire elimination of the potato moth two fumigations of each lot of potatoes may be needed, but if this is so, it will be arranged for. The treatment with petrol vapour is cheap, and easily carried out on a large scale, and the cultivators have become enthusiastic about it.

Fumigation to get rid of the potato moth involves protection of the fumigated seed from re-infection. This means storage either in bags, or under sand or some similar material. The latter method seems to have been used with success in Behar, but is impracticable in our districts. We have, hence, had to adopt the system of storage in bags, and hitherto this has meant that a good deal of the potato has rotted. Storage in bags is, in fact, in the opinion of cultivators, very dangerous and likely to cause very much rotting amoug the stored tubers, and it undoubtedly does so if the ordinary crop of potatoes is so stored. We have found, however, that if the fumigation is followed by a rigid selection as previously described, so as to eliminate the various diseases from the potatoes, the amount of rotting, even during storage in bags, is very small indeed, and unless the temperature is very high, does not lead to a greater loss than from two to three per cent. of the stored potatoes.

When, however, the temperature is very high, a new form of rot (which we term "black rot") supervenes and introduces a new difficulty. The latter is, however, now under careful study and we hope to be able to get over it in the course of the next season. In the meantime the storage house on these potato works has been constructed with double walls, protected roof, and as pefect æration as possible so as to reduce the danger of the " black rot to a minimum."

The nett result of all this is that we have been able to produce seed potatoes better than any hitherto on the market locally, and as good as those obtained from Italy.

Yield of Potato.

The last great difficulty of our potato cultivation is the relatively small yield obtained per acre. In other countries the average yield per acre of potatoes is approximately as follows :—

Germany	12,000 pounds.
Austria-Hungary	9,000 ,,
France	8,100 ,,

United Kingdom	... ...	7,450 pounds.
European Russia	... ...	6,000 ,,
United States	... ...	5,400 ,,

These are average figures, and of course there are many yields much higher than this, even up to 30,000 pounds per acre having been obtained. Here in the Poona district the average yield per acre is not greater than the following:—

Potatoes (rainy season)	...	5,500 pounds.
,, (cold weather)	...	7,700 ,,

This small yield, relatively to the better of the above countries, is due (1) to the prevalence of the diseases above named, chiefly carried by inferior seed, (2) in the rainy season, to the presence of large amount of *rhizoctonia* disease largely resulting from the wet and undrained character of the land, (3) to the insufficiency of the manure used.

The prevalence of the disease is to be met by the provision of pure seed, as has been already described, an effort in which the Union Agency are the pioneers.

The losses due to wrong methods of cultivation can be largely eliminated by demonstration of improved methods among the cultivators themselves, and this is going on, with the enthusiastic co-operation of the villagers.

The shortness of manure is a more difficult problem, as the possibility of increasing the supply of cattle manure is very remote. We have, however, shown that by the judicious use of artificial manures the yield can be increased to 15,000 pounds of potatoes per acre in the cold weather. At present the high price of these manures renders the extension of their use slow,—but as soon as the war is over and their price becomes normal, there will be a very considerable consumption.

As an example of what can be done the following experiment (in the *rabi* season) will indicate. The artificial manure used was a mixture of Sulphate of Potash, 150 lbs., Sulphate of Ammonia, 120 lbs., and Superphosphate, 280 lbs. per acre, in addition to the ordinary local dressing of cattle manure. The yield obtained per acre was as follows:—

Local manure alone	9,146 lbs. per acre.
Local manure and artificial manure.	14,918 lbs. per acre.

The increased *nett money* return at prices prevalent before the war, was no less than Rs. 70 per acre!

This short sketch of potato cultivation and its difficulties in the largest potato tract in Western India will show that the maintenance of an industry and its improvements is being tackled by co-operation between the Agricultural Department and a commercial firm, the Union Agency of Bombay, which has come forward to do pioneer work in this direction. I see no reason why potato cultivation should not extend widely, provided the difficulties I have mentioned are met,—and that they will be met in the near future I have no reasonable doubt.

The Ginger Crop in a Gujarat Village.

BY

M. G. Patel.

AN excellent example of the best type of Indian village of to-day is supplied by the village of Kelia Vasna in the Ahmedabad district. The soil is fertile, the people are very keen and industrious and hence a knowledge of their methods should have considerable value. Some of the information which I obtained from them during a stay in the village, together with my own observations have been combined together in the following short account of the methods they adopt.

The village is famous for its prosperous crop of ginger, which the people turn into *Sunth* (dry ginger). I will therefore give an account of this crop.

Thirty ploughings are given to the field, in which ginger is to be planted, in the course of six months. In the month of May from thirty to fifty cart-loads of farmyard manure are carefully spread in one *bigha*. The field is ploughed once again so that the manure and soil are completely mixed. The plot is then divided into one hundred beds per *bigha*. In the preparation of the manure all the dung together with the urine is collected from the cattle shed. The dung is not burnt here. All this is thrown in a pit. The pit is fifteen feet deep and is filled with rain water which causes the manure to decay and become ready for use. The pit is covered over with grass. The colour which the manure obtains is very dark not unlike that of black soil. Such a manure is considered good for the crop we are describing.

Good ginger is harvested in the month of March. The ginger sets are cleaned and the good ones are separated. These is are placed in a room where air and light are excluded. The room is examined every fortnight and the decayed sets are removed. This is done till the field is ready for sowing in the month of May. Forty maunds of ginger as originally taken give only twenty maunds at this time. The best sets are taken out for seed and the remainder is turned into *Sunth*. The upper coating of the sets for *Sunth* is removed before they are completely dry. Ten pounds of dry sets with five pounds of pieces of tile and five pounds of chalk are moved to and fro in a piece of cloth till the ginger sets are polished. This process is called *zolo*.

The method of planting is as follows :—A part with shoots, is carefully cut off from a set. Some holes in a line are made with the finger in the beds and one piece, with shoots on the upper side, is planted in each hole. When one bed is sown, a basketful of manure is spread over it. Watering follows. Each *bigha* requires twenty maunds of seed sets which generally cost one hundred rupees.

When the plantation is complete, *jowar* and *gawar* seeds are thrown at random in the beds, the reason for which is stated to be that the ginger plants must always remain shaded. Full watering is then given to the field every week. When the plants are one foot high, the *jowar* and some of the *gawar* plants are taken away. The *gawar* plants are cut into pieces and used as green manure. The remaining *gawar* plants are trimmed and kept for shade. Too much rain spoils the crop. The ginger sets in the ground decay and the colour of the plant becomes yellow. The beds where this change of colour is found are removed so that the adjoining beds may not be also spoilt. Such removed ginger sets are sold in the market in the months of September, October and November. Weeding is frequent during the growth of the plants. In January such portion of the crop as is ripe and likely to be spoilt by further keeping in the ground for two months is removed and turned into *Sunth*.

In March the best part of the crop namely that reserved for seed is taken. The blade of the spade used for digging is eighteen inches long and eight inches broad. The spade has a wooden handle four feet long. One watering is given at the time of digging which makes the soil soft. The blade must be so used as to go underneath the ginger set.

The roots of the plants are eighteen inches long. At the end of these there are small sets which are called *burbalas*. The *burbalas* are not as strong as true ginger sets.

The usual rotation adopted in this village is as follows :— (1) ginger, (2) *Cheno* (3) chillies (4) *Cheno* (5) *Bajri* or millet (6) *Jowar* (7) ginger. In the seventh year the ginger crop is taken in the same field. The manure applied for the ginger lasts for the six crops. People do not give any manure to the field for five successive crops. *Cheno* is ready after two months. This crop gives forty to sixty maunds per *bigha*. The chilli crop yields a gross return of Rs. 300 per *bigha*.

The total area of ginger plantation in this village is two hundred acres every year. The preservation of ginger sets for seeds depends much upon the rate of seed-sets per maund. The rate is settled in September and October by the cultivators for the ginger to be sold in December. One of the peculiarities of the village I saw, is that the whole trade in agricultural products and especially of this crop, rests in the hands of the agriculturists and not in those of the merchants. When ginger was first introduced in the village, the best crop yielded 120 maunds of ginger per *bigha*, but now-a-days the best crop yields 300 maunds per bigha.

Expenses per bigha.

20 maunds seed sets.	Rs. 100
Manure.	Rs. 100
Farm Servants.	Rs. 100
Water expenses and miscellaneous.	Rs. 200
	Rs. 500

Income per bigha.

The crop yields.	Rs. 1000
Profit per bigha.	Rs. 500

If the crop is not good, the farmer loses nothing, for, one bigha would at least give a crop worth Rs. 500. He has simply lost his labour.

Another New Fruit Recommended for Introduction into the Bombay Presidency.

BY

G. B. Patwardhan, B. Sc.,
Assistant Professor of Botany.

IN the Poona Agricultural College Magazine Vol. VII No. 3 p. p. 180, 181, 'A new Citrus Fruit in the Deccan' Called the Jamaica Orange was described and recommended as one, fit for introduction in the Deccan, in order that our cultivators may admit it into their orchards without hesitation.

I now propose to record the history of the introduction of another fruit tree, the trials given to it in the Ganeshkhind Gardens, Kirkee and the conclusions drawn as a result of trials and observations made on it during its growth there.

The scientific name of the plant of which I wish to speak is *Anona chirimola* mill, popularly called *Cherimova*. It is also known as Jamaica apple. Its leaves, flowers and fruits have considerable resemblance to *Anona squamosa* - the custard apple, *vern.* सिताफळ. The resemblance extends to the other two allied fruits known in the Deccan, namely (1) *Anona reticulata* or Bullock heart, *vern.* रामफळ, (2) *Anona muricata* or sour Sop, मायफळ. It has no vernacular name. Now I think one should be given to it. Taking into consideration the significance of the names of the allied fruits, it should be christened मारुतीफळ (Marathi), महाबीरफळ (Hindi), हणमफळ (Kanarese).

Jamaica is its place of origin where this species is found growing spontaneously in the mountains. It is also found wild in the Andes mountains of Peru and in adjacent tracts. "In Madeira, the trees are trained on trellis and take the place of grapes on the economy of the island." The plants have been successfully introduced some years back in the Nilgiri mountains in Southern India.

History of Introduction and Culture.—Six plants were introduced for the first in the Ganeshkhind gardens in December 1904 from Government Botanical Gardens, Ootacamund. One of these survived in a pot and was transplanted into a plot of the garden near a couple of small clumps of bamboo. It soon established itself and made fair growth for a time. Later on it became evident that the simultaneous growth of the adjacent bamboo retarded root extension of the plant which ceased to make any advance. It however continued to live and drag on an existence inspite of adverse surroundings for nearly eight years. It was then in 1912, that a broad trench four feet deep was dug round the tree cutting away the tangled mass of bamboo roots and isolating the plant from any further inroads of any foreign root system. Since then the tree has flushed forth into new growth and progressed well. It had not flowered in March 1913. This tree a fairly big one about eight feet high with a proportionate spread of branches was transplanted to another place, a congenial one, in August 1914 in good black soil where irrigation and weeding &c. were properly attended to. Four grafts were however secured from this tree before transplanting. They were on *Anona reticulata stock*, made in March 1914 and they became ready for planting out, in July 1914. Similarly an *Anona reticulata* seedling was budded upon a scion from the plant. This budded plant was four and a half feet high by the end of July 1914. It was planted along with the grafts and the parent tree in the new area.

The budded plant progressed very well, produced new shoots and foliage soon after planting, but had not flowered up to 9th August 1916, that is to say for two years. All these plants, however, yielded ripe fruits in November and December 1917.

A second lot of half a dozen plants were ordered again for trial early in 1913. These were also planted in July 1913 near the oldest tree, the bamboo trees in the plot being removed some time after. One of these remained there, the other, having been inadvertantly removed during clearings consequent on the destruction of the bamboo clumps. This tree yielded ripe fruits for the first time on 11th March 1917, that is to say about three and a half years after planting. We got ripe fruits from the plant in November 1917 also. This plant had not received all along as good cultural treatment as previously mentioned. It has been more or less neglected.

Description of tree, fruit and foliage.—The tree grows to a height of twelve to fifteen feet in the course of four years. It has long and spare branches not very twiggy, but bearing rows of alternate, flattened leaves which resemble in many respects those of *Anona reticulata.* They are ovate, or ovate lanceolate, velvetty tomentose when young. The foliage is darker green than that of *Anona reticulata.* The leaves are six to nine inches long by two to two and a half inches wide, the veins standing out but not very prominently.

The fruit is usually conical or heart-shaped, but occasionally rounded. Its surface is covered with V-shaped depressions which are deeper at the base than at the top. The areoles (depressions) appear as if caused by tips of one's fingers pressed in wax or putty. Near the stalk end upon about one third of the total surface are to be found small prickly tubercles or protuberances situated near the rounded apex of the areole. There is a little white bloom but not as much of it as in *Anona reticulata.* The pulp inside is white, sweet, of the consistency of butter very finely granular near the skin but not so much so as in *Anona squamosa,* easily separable from the black shining hard seeds. The pulp is thicker near the skin than is the case in the custard apple. The skin is not brittle. In flavour the fruit is superior to *Anona squamosa.* Our experts consider its flavour superior at any rate to *Ramphal.* The fruit keeps well, but finally it begins to decay from the stalks. On the whole I consider it well worth cultivating on a large scale. It is certainly highly valued elsewhere, and is considered as one of the finest of subtropical fruits.

Five varieties of *Chiromova* are described in Bailey's Encyclopedia of American Horticulture, viz.,

(1) Finger-printed cherimova form a unpressa.
(2) Tuberculate type-having a heart-shaped fruit.
(3) Mamillate type.
(4) Smooth cherimova.
(5) Umbonate cherimova.

None of our fruits are warty all over. The finger fruited type is said to be sweet. One fruit agrees with the type in respect to this character alone. The mamillate type is said to have been originally introduced into the Nilgiris from which our plants are descended. But our fruit does not tally with its parental type. Nor does it resemble completely the tuberculate type from which it differs in bearing both round and heart-shaped fruits. With none of the varieties mentioned does our fruit agree completely.

Recommendations.—The following are my conclusions and recommendations based on the history of its introduction—the trials the trees have had in the garden as described above and on my own observations and experience of culture received by the trees during nearly twelve years.

The variety is very hardy and stands a certain amount of indifferent attention. In soils of medium fertility, it gives the most satisfaction. It can be planted any time beeween June and November. It comes to bearing in two to two and a half years and gives two crops one in March and the other in November or December. An ordinary sized tree will bear from one hundred and fifty to two hundred fruits of the same size as *Ramphal.* The trees can be planted fifteen to sixteen feet apart. An acre will take about two hundred trees. They need not be frequently irrigated. One irrigation every fortnight even twenty days should be enough even in the dry weather. I should recommend plantings along the hedge rows of irrigated fields or orchards and along banks of rivers and *nalas* not occupied by any better paying trees. In moist tracts the plant is expected to establish itself easily and fruit well without irrigation. Ground treatment should consist of digging round the trees twice in the year once in May and the second time in October. Coarse farm-yard manure or house refuse will just be enough. Good farm-yard manure is still better. The manure should be mixed with the soil dug out in May and October. Fruit bearing branches hang down by the weight of fruit and must be supported by stakes. I have not observed any pest attacking either the tree or the fruit so far. It may be propogated by seeds, buds or grafts.

The Superintendent Ganeshkhind Gardens, Kirkee some time ago had about fifty plants in May for sale. He may still have some on hand. Those who desire to cultivate this new fruit should address inquiries direct to the Superintendent at the Gardens.

A Note on the Preparation of Different kinds of Betelnut.

BY

V. S. Habbu, B. Ag.,

Superintendent, *Kumta Farm.*

THE betelnut palm begins to come into flower from the month of March and continues to do so till May. Each tree bears three to four bunches which appear at an interval of fifteen to thirty days. The harvesting season commences in November and lasts till January. There are a number of different methods of preparing the nuts, and an account of these methods will possess some interest.

'*Chikni*'.—For this, only tender nuts are made use of. To ascertain whether the nuts have reached the right stage required for preparing *chikni* variety, a few nuts are removed and peeled. They are then pressed tight between the fingers to see whether the eyebud or germ comes out. If it does, the nut is still too tender, and if it does not it is considered to be fit. A further test lies in pressing the finger nail into the peeled nut. If the nail penetrates easily and if the eyebud does not come out when pressed, the right stage for *chikni* making has been arrived at. If the surface be hard, this stage has passed off and the nuts cannot be used for *chikni*.

'*Bharda*'.—All the nuts in a bunch cannot be turned into *chikni*, as all of them are not in the same stage of ripeness. Those that have passed the stage for *chikni* making will be used for *bharda*. If the bunches are harvested for *chikni* variety some of them will be useful for *bharda* and the proportion of *chikni* to *bharda* will then be three to one. If harvested for making *bharda* the proportion will be reversed.

Preparation of Chikni and Bharda.—The bunches are removed at the stage mentioned above and the husks are taken off the nuts. The scraped nuts are boiled for about two hours in large copper pots. The boiling is continued until the eyebuds come out and float. It is not necessary that the eyebuds from all the nuts should come out. It is enough if a large percentage of them do so. They should neither be overboiled nor underboiled, the result in both the cases being poor quality and consequently a low price. The nuts are then taken out and put into a basket by means of a ladle. The ladle has perforations in the bowl which allow the extract to drain into the pot again. They are then taken to a *mandap* specially prepared, where it is possible to get full sunshine, and spread thinly on a mat for drying. While spreading, care is taken to see that all the nuts lie with their eyebud sides downwards. If they are allowed to lie on the other sides, they lose shape and do not attract attention. Towards the evening of the second day they are gathered together and covered over so that the dew may not collect over the surface which is likely to spoil the colour. On the first night they are not covered, presumably the surface of the nuts being sticky. From the second day they are covered at night. On the fourth day sorting of the nuts into *chikni* and *bharda* is made and separate heaps are formed. They are further dried for three days more. The *chikni* heap is invariably covered at night whilst the *bharda* heap is not. Then they are ready for being coloured.

Colouring.—The water which is employed for the first lot is used again for four or five lots of nuts. It becomes thick with the resinous extract from the nuts. This extract or decoction is emptied into a broad mouthed pot and exposed to the sun. This on account of evaporation becomes very thick and is used for colouring. The leaves of *Terminalia tomentosa* are at times used, which helps to redden the decoction. To *chikni* some add this liquid colour whilst some do not. But the merchants always do it to give them a good appearance. The thick liquid is poured over the nuts which are rubbed with the hand so that all of them get besmeared. *Bharda* do not take colour easily and for this reason three or four per cent. of lime is added to the paste before using and the colouring process has to be repeated three or four times.

Grading :—*Chikni* is sorted into *Ani* (आणि) which is very fine and fetches a very high price. There are also classes which go by the name of Amraoti *Ani*, Hinganghati *Ani* etc. *Bharda* is classed as fine *bharda*, ordinary and mixed.

Rota.—Shrivardhan is specially noted for *rota* supari. For this purpose the *supari* bunches are allowed to ripen fully until they are reddish yellow in colour. They are then harvested, the husks are removed. The nuts being overripe, the shell enveloping the nuts cannot be removed until they are fully dry. After husking they are dried in the sun for nearly twenty days by which time the nut inside the coat moves freely when shaken. The nuts when this coat is removed present a white surface, whilst the kernel is soft and can be out into thin slices. There is no colouring process in preparing this from the betelnut.

Agricultural Education to Sons of Farmers.

BY

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BEFORE going into the subject matter, it will be well to consider, first, just a few general points as to what is meant by education, whether the farmer really stands in need of it and further, whether the present mode of rural teaching enables him to carry on his profession advantageously so that what should be done to help the young farmer.

Education is gaining knowledge. It properly consists in equipping oneself with the knowledge necessary to do a thing one undertakes, as efficiently and perfectly as possible, getting up-to-date information regarding the same from all the possible sources. It does not consist as is usually supposed, in mere reading and writing, though they are the means to that end. While it is not always necessary to be educated in schools, in order to gain knowledge, yet, the school room with all its limitations, is usually the most efficient method of acquiring certain forms of knowledge essential to every successful man. Thorough knowledge, one's professien, howsoever it may be acquired, is then called *Education.* A course of education, by means of which expert knowledge in agriculture is gained, is called *Agricultural Education.*

At the outset, let us ask ourselves whether the farmer really stands in need of education. It is a general belief that agriculture is not a subject to be studied in schools and that the agriculturist needs no education to follow his calling, it being supposed that it is a thing, which can be done by practical experience and that he has enough of it. In matters of this kind, we should beware of unintentional exaggeration and we shall have to ask ourselves, whether most of our agriculturists don't go through a course of home training and a rigorous one at that. The reply is yes. A considerable part of the knowledge essential to success in every profession, or pursuit, is acquired by actual working at the occupation, or, as we say, by practical experience. Some features of any occupation can be obtained in no other way. From their earlier days the farmers' children have ample opportunities to familiarise themselves with the secrets of paternal success. Given good natural aptitudes and inborn love for work, it is difficult to imagine training in agriculture, more thorough than the early apprenticeship, under a successful farmer, provided always, however, that he elected to follow his calling, under conditions substantially similar to those with which his long custom has rendered him familiar.

In short, so long as a cultivator finds himself confronted with an environment essentially similar to that of his sire, the home training imposed on him should, as a rule, prove equal to the usual contingencies of life. The home training is good, indeed excellent, only so long as economic conditions remain tolerably stable; where there is economic stagnation for lengthy periods of time, there the traditional method of farming shows up to the best advantage. But, even here, the cheapness and the rapidity of modern means of transport and the thoroughness with which the markets of the globe are explored and exploited, are apt sometimes to disturb even the most sober of local markets and it is then that the parochial farmer is faced with heavy loss, because in some distant part of the globe, his particular speciality can be produced, conveyed and sold on his own particular market at lower cost than he himself is able to do and in such cases, time-honoured paternal rules are apt to fail and the lack of more liberal training is keenly felt.

It is quite evident that there has been a vast change in our economic conditions in recent years. The population has increased, means for quick transport and communication have been devised and the markets of the world have been thoroughly explored and organised. Formerly, there was a vast area of virgin land at command, the system of using up the land and then moving on to fresh areas was in vogue. The people then used to grow only enough of everything they wanted in their own locality, that is to say, they followed what is called subsistence farming. Need of scientific farming, however useful and desirable, was not then felt, increase in production being easily secured by extending cultivation to fresh areas. Consequently special training was unnecessary. But the conditions have now changed with increase of population. Cultivation has reached its limits of expansion. Trade relations have changed. Perfected means of communication and transport have thrown each farmer into competition with the world. We are now required to run a race in the world's market. In order successfully to compete with others in the world's market, we must be able to produce in a given space of land more outturn at less cost so as to be able to undersell others, else, we shall be ousted from our market.

If we consider for a moment about the margin of profit which is left to the cultivator here, in the cultivation of his crops in general, we shall find that little or no profit is left to him except what may be considered a fair wage for the labour put in by himself and his family. The main items where the cultivator loses are :—

(1) The number of plants per acre is not what it ought to be, there being many gaps owing to improper sowing or planting and bad seed.

(2) The growth of the plants is not as vigorous as it ought to be, owing to weedy, slopy and an unusually wet or salty condition of the land, careless tillage, want of proper manuring and improper or no selection of seed.

(3) The outturn producing capacity of the seed is lowering to deterioration of seed, for want of knowledge of breeding and selection of plants.

(4) The labour bill is high, owing to inefficient labour and horn cattle, prejudice regarding the use of labour saving machinery, and want of organisation for cheapening credit and purchase of agricultural supplies.

(5) The proper value for the produce is not obtained owing to want of organisation for sale of produce.

In case of crops like cane, further losses occur in the cutting of cane before fully ripe, extraction of juice by inefficient mills and preparation of gul by the inefficient method of boiling the juice. The result of all this is that the cultivator hardly gets profit in the cultivation of his crops. It will be clear from the above, that unless agriculture is now carried on as a business, paying attention to every detail and doing things in a business-like way, it will not pay. We now stand between intensive and extensive farming. In these days, intelligence, coupled with business capacity, is of more advantage than when our competitors were not so earnestly studying all the questions relating to their business. Agriculture is no longer what it once was—a rude, rustic husbandry, a simple manual, mechanical operation, an empirical pursuit. It has now become an industrial pursuit of a highly complex and difficult nature, requiring for its successful prosecution an application of several sciences.

While there is much the farmer can do only by experience, there are many things essential to his success that the mere performance of the farm operations will not teach him and which he must now be thoroughly acquainted with. Spreading manure will not teach him that farm-yard manure should be supplemented with other food ingredients according to the requirements of crops grown to get the best results. Feeding of cattle will not teach him what ingredients the feed given should consist of and what the proportion of the different ingredients (nutritive ratio) should be, for different types of animals doing different kinds of work, to give the best results in feeding. Nor will feeding of such a ration teach the farmer how to calculate the most economical ration from feeding stuffs at different prices. The cause of plant diseases and the method of combating them cannot be learnt from the operations of planting and cultivating the crops. These are only a few illustrations to show that farming is peculiar in that, performance of the daily duties does not give the knowledge essential to success in the proper manner. Science and science-guided skill and business capacity are in these days necessary requisites of practical success. Yet curiously enough, there are many who undertake farming without adequate training or knowledge of the business. The aid of applied science is necessary to help in the change.

In most foreign countries, such a change has taken place in the last few years. But in India, the industry continues in its old grooves, largely due to the fact that a majority of the *ryots* are illiterate and that those few who are supposed to be literate have either received little or insufficient education, or have received education of an entirely unsuitable nature. As to the value of the teaching at present being imparted in our rural schools, there is much to be said. What is taught are the three R's–reading, writing, and arithmetic—with a little of Grammar, Geography and History. The three R's are no doubt necessary since they are the means to gain further knowledge. They may add to the happiness of the young cultivator, if used only as a basis or foundation on which the superstructure of further technical knowledge is to be built up; but the skill or enthusiasm of the teacher has made the three R's a science in themselves and what was meant to be the elements of knowledge has become a specialised technical training resulting in the veils lying behind it, namely, the attractions of the city and the clerk's desk, as against a farmers' life. Thus the three R's, instead of bringing happiness, bring restlessness and discontent and the present teaching tends to lead the farmer away from the farm. The primary or secondary schools, in fact, are simply feeding boys to the literary college.

Even if this does not follow, do the three R's themselves make the cultivator a better man at his trade ? If rural education does not effect this purpose, it is a barren gift. If it tends to uproot the rising generation from the soil, it is an evil. It is a familiar complaint of the parent that his boy has apparently learnt nothing at school which concerns his trade or which can be turned to immediate benefit. In the rural school, there is never a word spoken about sowing and reaping, nothing about planting and tending trees, nothing about the production of milk, butter or anything of the kind. The very fact that in rural schools, children come from home where the livelihood is earned out of the ground, is ignored in the lessons. Why not a course of training in the rural school for the rural children, which shall teach them more about rural life around them ? Along with his study of some peculiar unseen animals, why not a study of the animals of the farm, implements, and types of grains and vegetables ? Instead of all the boy's arithmetic being devoted to problems more or less theoretical on Banking, Stock, Exchanges, Proportion etc., why not some practical problems with reference to farm economics ? For the boys who will remain on the farm, the course of instruction should be such as will be an inspiration and help in their future life work. The present teaching in rural schools seems to aim at producing a nation of clerks ard more or less theoretical teachers, for it is only to those, that perfection in writing and spelling is required. It not only bears no relation to the life the rural boys are to lead but actually attracts them towards a town career. To this fact more than any other is due the present deplorable state of our ryots who are not even in a position to realise their own situation. They do not understand the immense losses they have been put to, by imperfect or unsuitable education or total absence of the same.

This is pre-eminently an age of applied science, it is intensely practical. The average individual comes in daily contact with the problems of science as never before. Science work in elementary schools should therefore play an important part in the education of our youths who go into life as a vast of them do with no further fitting than that received in the elementary school or secondary school at the most. This suggests an urgent need for modification in our present rural teaching, so as to make it better suited for the kind of life in which most of our young people are launching. All such teaching as this, will call for a new purpose in the school building. The present country school building is a structure in which children sit to read books and recite from them. It should be also a place in which the children can work with their hands. Every school should have facilities so as to enable the children to experiment with plants, insects and soil and to perform some manurial operations, actually in the land. With a view to modify the present rural teaching on the above lines, the subject of agricultural education was opened and discussed at the agricultural conference held at Poona in the year 1910. The educational authorities would not undertake the task of imparting agricultural instruction in the primary schools under their control for some reason or other. Considering the extreme importance and urgent need of such a training for farmers, Dr. Mann, the Principal of the Poona Agricultural College, moved the meeting to resolve that all schools in vernacular should be opened and worked by the Agricultural Department and sanction was accorded by Government :to open such schools as an experimental measure. Their working, so far goes to show that such schools are of immediate direct benefit to the cultivators. The course is a purely practical one consisting as it does of the elementary knowledge of the sciences and their application in the ordinary farm operations. A small farm is attached to each of these schools where children grow with their own hands different crops according to improved methods of cultivation. The usual defects of the cultivators are vividly brought to their notice and the importance of attending to details and dignity of labour is impressed on their minds. The 'why' and the 'how' of the different farm operations are explained and the mind, the eye and the hand are trained so as to enable the children to develop their power of thinking, observation and manual work. Thorough grounding is given in such operations, as are likely to be of immediate utility when they go back to their farm, such as ploughing, grafting, repairing petty agricultural tools, gul-making, gudar weaving, ropemaking, and land surveying. A little of reading, writing and arithmetic is also taught, in order to enable the young farmer to keep accounts and exactly ascertain his financial status at any particular moment. Problems in arithmetic are devised so as to explain or rather impress in the minds of the children the importance of the different farm operations and the use of selected seed and labour saving machinery and so forth. Principles of co-operation are explained and their application in agriculture is illustrated by the vivid living examples of the various types of societies now at work. Care is also taken to see that the moral development of the boys is not neglected. In short, the school aims at giving them a training sound in all respects so as to stand them in good stead when they go back and enable them to undertake farming as a paying business and also fit them successfully to fight out the battle of life.

But there are many practical difficulties in the working of these schools under the existing circumstances. In the first place, the people are not ready to receive training of the type indicated above. They consider that a cultivator does not need any such training and that their present knowledge of their business is quite sufficient, and further, they suggest that what is advocated by the agricultural department is too costly to be undertaken by them. In the second place, agriculture does not afford sufficient interest to the farmers of the present day who see no easy jobs, immediate returns nor the fascinating comforts of the city. In the third place, the average cultivator does not wish to part with his boys for a year or two for the purpose of getting agricultural education. And lastly, the present mode of teaching in rural schools whence we derive our students does not even prepare the minds of students to take agricultural work, far from this—it actually tends to take them away from the farm.

How can a child, born and reared in the country, respect the life of a farmer when the community in which he lives does not regard the farmer's occupation as worthy of study? How can he be expected to look with ambition towards agriculture as a vocation, when he finds that training for it is regarded as less important than preparation for the clerkship? How can he think of rural life as anything more than a make-shift when he finds that in the school he attends, there is not a word taught concerning crops or cattle?

Difficulties of the type above mentioned are bound to arise in the beginning. They will have to be intelligently overcome before the movement can be a complete success. The movement needs on the one hand, co-operation and sympathy of the enlightened public to secure suitable boys to the school and on the other hand, hard and strenuous efforts coupled with intelligence and commanding personality of the officers responsible for the success of the movement to make the school instructive, interesting and attractive.

It should not, however, be supposed that training of the boys ends in the schools; they will have to gain practical experiences as they work along on their farms. But here, they need supervision, help and encouragement, which should be provided for, by the school authorities as forming part of their duty. Else the young boys are, under the existing rural conditions, apt to be scared at and discouraged with the result that they may leave the new path they have been shown to be useful and thus render the time, energy and capital spent on them futile. The movement is still in its infancy and in course of time, it is bound to be developed. There is sure to be more demand for these schools. But the question of capital comes in. Schools of the type now at work under the agricultural department are of the nature of secondary schools and are expensive to some extent. Besides, boarding expenses are also for the present met by the Government. Such schools cannot, without due limitation, be possibly increased. In order that these schools may serve a general demand, they may have to be modified and worked on the lines of Sirdar Biwalkar's school opened at Veshvi purely on the initiative of Dr. Mann, the originator of the movement in the Presidency, which is of the nature of a primary school. It will, however, be necessary to retain some schools of the present type in a few important centres, to serve as secondary institutions to give advanced courses to the boys proceeding from primary agricultural institutions of the type of Veshvi school. The remarks made by one of the Collectors of Dharwar regarding usefulness and necessity of both types of schools are worth noting. He said:

"I have been much interested in my visit to the village (Devihosur) and agricultural school which I had long wished to see especially in order to compare it with the agricultural school I know at Alibag (Veshvi). The latter school takes much smaller boys, takes charge of their primary education and gives them an agricultural bent from the first. This school is more of a secondary school and the boys are all big. They are real agriculturists, already half made and this school gives them the best typical knowledge. I think both of these schools are useful".

(*To be continued.*)

Notes on the Growth of the Varieties of Ficus in Western India.

BY

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ONE of the well-known peculiarities of the various species of Ficus is the power of giving aerial roots, a power which reaches its greatest development in the *banyan* (*Ficus bangalensis*). But detailed observations with regard to the conditions under which they are produced are almost wholly lacking. For instance, I have never seen it noted that in the case of *ficus* trees growing by the roadside, the aerial roots are far more abundantly developed on the side facing the road than on the opposite face of the tree. And yet, this is the case as my little observation will show. Again, as regards the *pipal*, (*Ficus religiosa*) it is generally stated that it does not show any aerial roots. Gamble (Manual of Indian Timbers page 644) states this as a fact. Yet, I have seen large numbers of *pipal* trees which have given aerial roots in abundance.

The following notes, made in the course of my work, on details which I have personally noticed, may therefore be of interest. I commence with the ordinary *banyan* tree (*Ficus bengalensis*). This common tree, almost ever green, fast growing, and easily propagated by large stumps or cutting, forms one of the most useful avenue and roadside trees in India. Stumps eight to ten feet long planted in July succeed very well. In nature, its usual method of propagation is as a parasite on other forest trees, but the artificial raising of a banyan seedling is somewhat difficult, and requires a great deal of experience and care. I believe the very great difficulty in propagation from seeds of such a beautiful tree is the origin of the sacredness of the plant among the Hindus.

The most striking feature of the banyan tree is its capacity to send down aerial roots from the branches in enormous numbers. These grow into separate trunks, which serve as supports for the branches, as feeders for the tree, and if such trunks be separated from the mother plant, they perform the function of the trees, Remarkable examples can be seen in Western India within a mile from Thana on the Bombay–Agra road, and near Manjri Farm on the Poona–Sholapur road in the Poona District.

Mr. Woodrow says that the seedlings grow rapidly and make more upright trees than those derived from cuttings. Plants raised from seed certainly assume an erect habit, and have less tendency to form aerial roots. Examples of such trees can be seen in the Ficus avenue near Matunga, Bombay, and a special tree in the Improvement Trust Gardens Bombay. I believe the cause of this peculiarity is that as long as the terminal bud is uninjured the main tendency is to develop through it; when it is damaged or destroyed the lateral buds develop, and do not immediately give straight vertical growth. The branching thus produced causes a permanent tendency to the formation of horizontal branches, and these conditions favour the production of aerial roots.

In the case of the *banyan*, drier and more open situations, such as Kathiawad or Northern India, tend to dwarf the plant, while in the thick forests such as those of North Kanara, the plants grow tall, and show their competition for light with other trees. I believe, however, that they are rather competitors for moisture than for light, and that the need for large quantities of water is the dominant feature in determining the height of the plant. Mr. Gamble says, "In Bengal, the aerial roots and long branches are usually more developed than in Northern India, but the trunk in the latter drier region attains a larger girth, often twenty five to thirty feet." "In forest it does not seem to spread so widely as in the open." (*Loc. cit* p. 639).

It is difficult to determine whether light or moisture is the principal regulating factor in the growth of trees in the forest. But this question is easily solved by the study of *banyan* avenues in the open. In the forest moisture is obtainable from all sides and hence, light becomes the most important factor in determing the direction of growth,—while the plants being chiefly seedlings have a natural tendency to become erect. In avenues on the other hand, where there is abundant light, the trees always tend to spread most vigorously and furthest horizontally in the direction in which most moisture is available. The particular trees and avenues cited above, are illustrations of this, and to them I may add the *ficus* avenue in Queens Road, Bombay.

The lopsided growth of *banyan* trees in avenues on roadside, where other things have equally the most vigorous growth generally occurs towards the road itself, is possibly, in many cases, due to the fact that the first shoot on this side will usually be specially encouraged by the Arboriculturist, while those on the other sides are largely neglected. The more horizontal the branching, the more the aerial roots, and as the first shoots from a stump are more horizontal than later ones, there is usually a large growth of aerial roots towards the road than on the opposite side.

Why should horizontal branches bear more aerial roots? It may have been observed that the lower side of horizontal branches is generally wet early in the morning in the cold weather, and after the end of the monsoon, and that this wetness (by virtue of its being protected by its position from the effect of the sun and wind) remains longer here than on more erect branches. This induces, I think, the formation of aerial roots here, more than elsewhere. The roots start growth just below the *callus* and then goes round the brushwood (if any). If a *banyan* branch is crowngrafted (lopped) the portion behind the graft swells and shows clearly the accumulation of nourishment at this spot, it is from this that the aerial roots specially develop.

The conclusions which I have arrived at, from these observations are that the production of aerial roots requires horizontal branching, injury, however slight to the bark, accumulation of nourishment, abundant moisture, local or general, and protection from sun and wind. All these favourable conditions are usually more available towards the roads rather than at the other side of the tree.

One of the other varieties of *Ficus* known as *Nandruk* (*Ficus retusa*) also gives numerous aerial roots. These are hairy and when they come in contact with the main axis or trunk they grow in thickness and form a part of the trunk. All the other rules above stated for the *banyan* seem to hold equally for this species.

The *pipri* (*Ficus tsiela*) is generally believed to be without aerial roots. Mr. Gamble states (*Loc cit.*) that for a fact, but it is not universally the case. There is a tree of this species near the Mahalaxmi Station of the B. B. and C. I. Railway, Bombay which bears hairy roots.

Ficus elastica has numerous aerial roots from the branches each of which may form an independent tree. Examples of this can be seen at the Victoria Gardens, Bombay.

Ficus religiosa (*Pipal*) is supposed to have no aerial roots. I however, have seen many in the Bombay Presidency bearing such, the only difference between the roots of this tree and those of the *banyan* is that they appear on the branches close to the trunk, and ultimately become part of the trunk. Young plants do not show such roots, but mature plants have abundance in moist district. An avenue showing many such trees can be seen in Bellasis Road, Bombay and near the Byculla Bridge. A case of such roots hanging from the branches can be seen at Panse's Wadi, Bombay. It is due to the fact of the tree being protected on three sides by buildings. They show, however, a very marked tendency to grow towards the trunk.

Ficus infectoria, *Artocarsus Lakoocha* and *Ficus benjamina* give wiry aerial roots and seem subject to the same rules as in the case of the *banyan*.

Ficus glomerata do not produce any aerial roots, though I have one doubtful case under observation near Madhavbag in Bombay.

Note on Teff on the Harrar Plateau, Abyssinia.

BY

Lt. D. S. Corlett.

(A letter written from Harrar.)

WITH regards an enquiry from the Royal Botanical Gardens at Kew referring to the product of Teff grain in Abyssinia, I can only furnish information gathered here at Harrar.

I am acquainted with the product, as I imported it from South Africa for trial in Ceylon. Both at Peradeniya (2,000 ft.) and at Anuradhapura (200 feet) above sea level, it grew well as a fodder grass and bore three cuttings before seeding. The seeds were very small compared to the grain I have been shown here. This may be due either to the previous cuttings for fodder before seeding, or to the elevation. In Abyssinia it is grown at the higher elevations of Harrar (6,000 feet) and Adie Ababa (8,000 feet).

At Harrar it is only grown for the grain and never cut as fodder. It is a cereal of so great importance compared with the other cereals grown in the Province. Only one crop a year is cultivated. The seasonal words "*Hagaiz*" and "*Tseddia*" are not understood by the cultivators of Harrar.

It is sown broadcast in July, in order that it may be harvested in October during the dry weather, otherwise the heavy rains would damage the grain. The straw is fed to cattle and horses. Only two varieties are cultivated, with the Galia names of "*Fandisha*", a white grain, which being considered the better is reserved for the use of the Chiefs, and "*Hoira*", either a red or dark-brown grain.

I understand that this crop is grown in larger quantities around Adie Ababa where there is comparatively little *Dourah* and Maize, and it is in this district that probably two crops are cultivated as the rainy period is much heavier. Thus the first crop would be taken for fodder in August and the second allowed to ripen for harvesting in the dry month of November.

The fodder grass known as "Red-top" in South Africa is found wild on the hill sides of Harrar.

An Ecological Study of the Chattarshingee Forest Reserve.

BY

M. Ezekiel, M. SC.

THERE is perhaps no area in the Bombay Presidency, that has received more painstaking and prolonged attention at the hands of collectors and taxonomists, than the easily approachable trap-hills, near and round about Poona. Very few visitors seem to have interested themselves in the vegetation of these hills in their physiognomic and physiological aspects. These hills, however, are most interesting to the ecologist because of their being places, where the factors controlling plant-life are operating in an extreme degree.

The rocky nature of the subsoil on the south-west of the top, and over almost the whole of the western slope and southern point, (the latter designed throughout the paper as 'Fergusson Point') the extremely calcareous nature of the soil at the extreme north-eastern point, called throughout the paper 'Burns Point', and also on the south-east side, the alluvial nature of the soil between the north and south points, (i. e. at the base of the 'Vetal Hill') and the enormous number of huge anthills on the west base, make the study of the area much more interesting, than would at first sight appear. Add to this the comparative barrenness of the west slope, most part of the top, and the area becomes still more so to the student of ecology.

This area lies on Lat. 18°-30′-2″ N. and Long. 73°-53′-33″ E. about 2083 ft. above sea level. The annual rainfall of Poona is 25 inches, the mean temperature ranges from 55° to 96°F. and the rock is trap, both solid and amygdaloidal. The maximum height of the hill is 240 feet, from the level of the Agricultural College.

The study of the area was commenced in June 1916, and the hill was visited as often as possible, - about twenty times from June to October 1916, and as often from February 1917 to November 1917, sometimes in the morning, sometimes in the noon or afternoon and sometimes an hour or so before sunset, so that no plants, opening their flowers at these times, be missed. The numerous visits to the area were given to making an acquaintance of all characteristics-climatic, littoral and floristic. Though the study of each of these, considerably overlaps the others, yet for convenience, the paper has been divided into three parts.

I. Climate Study.
II. Soil Study.
III. Plant Study.

I. *Climate Study.*

The Poona year may be divided into three seasons. The cold season from November to February, the hot season from March to June and the wet season from June to October. The cold season begins in November and ends in February. The coldest month is January. Cold land breezes prevail with sea breezes mostly after sun down. The hot season may be said to begin in the middle of March, and end in June, though the hot winds and the chief characteristics of the hot weather are over by the middle of May. At the beginning of the hot weather the wind blows from the east in the morning and from the west in the afternoon. In the latter part of the hot weather, excepting during thunder-storms there is no easterly or land breeze. The sea breeze sets in at about three in the afternoon and somewhat earlier in the extreme west.

At the beginning of the hot weather, the wind blows from the east in the morning and from the west in the afternoon. During April the temperature at Poona sometimes rises over 100° F, the sun's rays then being nearly vertical for weeks. The thunder-storms occasionally break the heat but they are generally accompanied by cloud and sultry weather. During the hot season the air is darkened by a dry haze. April and May though the hottest are not the driest months. The sun beating on the ocean in the middle of March, raises large masses of vapour which continues to increase as the sun passes north. The westerly winds carry this vapour across the Konkan and over the west Deccan. In the western hills from about the 10th of May, the vapour begins to condense in the cool of the evening, in heavy dews and refreshing mists and over the centre and east it gathers in great thunder storms. In the east and centre of the district, sometimes early in May, but as a rule not till towards the close of the month, after three or four oppressive days, in the afternoon, clouds gather in the east in great masses, and with a strong blast from the north east, drive west, with thunder and heavy rain. These are what are known as premonsoon showers. Over the whole of the district the chief supply of rain is from the S. W. monsoon which begins about the middle of June and lasts till the end of September. Special returns compiled by Mr. Moore, the Collector of Poona, for five years ending 1882, separate the three sources of rain supply, the easterly thunder-storms in May, the S. W. rain between June and the end of September, and rain from the north east in October at the beginning of the N. E. monsoon. The greatest fall of rain recorded in any one day is 7·90 inches. The returns show that during the four months in the year, March, April, May and June the temperature was above and that during the eight months the temperature was below the mean. The average daily range of temperature for the year is about double the range for the wet months from June to August. The range during the cold half year is generally great compared with the range of the hot and wet halves. The variation is least in June (8·5) and most in February and March (21·2 each). The annual variations of vapour pressure give high values in the hot and wet months i. e. from May to September, and low values in the cold months, the month of maximum vapour pressure is June. Dews appear in the latter part of October and last till the end of February. Fogs are rare.

Winds.—The chief feature in regard to the direction of the Poona winds is the commonness of the easterly and westerly winds, and the rareness of the winds from the north and south. The period of strongest wind is during April, and in May till the easterly thunder storms begin. Easterly winds are extremely dry and dangerous to sleep in."*

In a careful study of the climate of a place, it is not sufficient to know the maximum and minimum temperature and the mean annual rainfall. Even an estimate of the number of rainy days, is not sufficient to give the reader a clear idea of the climate of the place. For, while the maximum and minimum temperature of two places may be almost the same, the period during which the rain falls, time of its commencement and the time of its cessation, the period during which small but appreciable precipitations occur, and which latter are generally thought to be negligible, are of intense importance in the physiognomic and physiological study of a limited area.

In the present case, there is no other important form of precipitation than rain, hail and snow being almost unknown, although the former occurs at intervals in various parts of Poona

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* **Poona Gazetteer, 1884.**

City and its surroundings. The precipitation is either in the form of heavy showers of brief duration, or the prolonged but gentle drizlings characteristic of Poona, which make it so pleasant a place to stay in, during the wet months. There is rarely the hard downpour of large rain-drops, so characteristic of Lonavla—a place not more than forty miles west. Nor do we find the rain continuing for days together, which is so common an experience there. No indication of the relative amounts of sunshine and cloudiness can be given by the figures exhibiting the number of rainy days, owing to the high frequency of cloudy days on which there is not an appreciable amount of precipitation. The wind on the hill is chiefly from the west and south-west and commonly reaches its highest force in May and June. Its influence on the vegetation is the greatest on the top and the western slope, and the fact that the low humidity of May accompanies high winds makes its dessicating influence considerable. The scanty vegetation of the hill subjects its soil-rock to full insolation and pronounced heating throughout the day. The dark rocks of the hill become so hot during the long clear days of April and May that it is impossible to hold one's hand on them without pain. During the day there is a constant and active radiation of heat from the rock and soil which warms the lowest layers of the air and causes a convectional heating of the lowest portion of the atmosphere. Immediately after sun-set, the warm surface becomes rapidly cooler, and the rate of radiation is quickly reduced. The air nearest the cooling rocks on the east slope becomes cooler than the air above it, and consequently begins to fall by gravity, before there is opportunity for it to mix with the warmer air above. This cooler air descends from the hill sides and gentle slopes and soon collects in depressions where it results in a slowly moving mass of air which is apparently cooler to the senses than the air of the slopes.

During the moist seasons the ratio of water to water lost is such as to make conditions favourable for all plants. The strong winds of April and May are too dessicating to allow plants other than those present, to hold the soil. This is seen best on the west slope. In spite of the strong westerly breezes that prevail on the hill wind-throws are merely local and of very small extent. In fact areas in which wind-throws are expecting to be seen, are conspicuous by the absence of forest vegetation. This is very clearly marked on the western slope. The few plants that do stand the dessicating influence of wind adapt themselves to their surroundings, by having a thick bark on the stem and branches and a thick cuticle on the leaves. An extreme example of the formation of conspicuously thick woody tissue is shown by *Eleodendron glaucum*. A stout foot-ball-like structure is formed at the best of the stem, as an adaptation for withstanding the strong tearing forces of the western winds. Only in areas protected by deep ridges, are to be found a few individuals of *Boswellia serrata*, *Roxb*, *Acacia*, *Flueggia leucopyrus and Cochlospermum Gossypium D. C.*

General Conditions.—At the commencement of the rains, the temperature both of the soil and of the air, permits on the one hand very rapid growth, and on the other the best conditions for water absorption, with the result that the root-systems of the plants are well developed. Since the superficial soil up to seven or eight inches becomes rapidly dry, with a percentage of water which is not available to the herbaceous species, the majority of which are delicate and very sensitive to drought, they complete their reproductive processes before dessicating and more injurious conditions appear, so that, in years of smaller rainfall, and in years when the rain is off earlier, the herbaceous species are "forced" and begin to flower and fruit when they are comparatively small in size. There are some among these, whose chief adaptation is extreme brevity of existence. *Scilla indica*, *Cleome simplicifolia*, *Asparagus racemosus*, *Iphigenis indica*, *Curculigo orchoides*, *Chlorophytum laxum*, *Ceropegia hireuta*, deserve special mention. *Scilla indica* and *Iphigenis indica* have the briefest life-history. Soon after the first rains, these plants may be seen above ground and the flowers appear within about a fortnignt after the first rains. In Poona in 1917 the first rain fell on the 30th of May and the plants were first seen in flower on the 19th of June.

II. *Soil Study.*

The soil of the hill is extremely varied in chemical composition, physical characters, and depth. The deepest of the soil is a dark clay which occurs at the west base of the Vetal Hill, and is characterised by deep though not broad cracks. On the same slope occurs soil of similar composition but mixed with a large number of coarse rock-fragments, disintegrated by weathering action, and by the action of the roots of powerful petrophytes which predominate at the top. When passing along the base of the hill from 'Burns point' in the north to 'Fergusson point' in the south, one meets with the following types of soil, and in that order. Extremely calcareous, calcareous and loamy mixed in equal proportions, purely alluvial, and extremely calcareous. The calcareous nature of the soil makes the growing of delicate crops at the base of the hill, a practical impossibility. The only agricultural operations at the base of the east slope, is the cultivation of *jowar* as a *kharif* crop. The fields are invaded by numerous weeds from the slopes and seem to be allowed to hold their own. In April and May the floor of the hill is seen to be covered with a litter of leaves, and twigs. The decay of these seems to be retarded by the extremely arid conditions maintained at high temperature. The soil is poor in organic matter except in regions at the mouths of the ephemeral streamlets near the base of the hill, and especially near the east base of the Vetal hill. On the eastern side near the base, the soil is very deep, sometimes fifteen feet or more, but in other parts is shallow and full of angular and rounded rock-fragments, disintegrated by the powerful action of the petrophytes referred to in the next part of the present paper.

The terrestrial herbaceous vegetation varies from extreme wealth in one ravine, under the shade of some trees and at the east base of the Vetal hill, to almost complete absence in many places, such as large areas on the south west slope and the base of the 'Burns point'. The eastern slope and the base of the Vetal hill and the whole area to the east is richer in vegetation, in organic matter and the soil depth varies from six feet to fifteen feet. The soil at the base of the Vetal hill, is particularly rich in organic matter as is evident from the enormous number of huge earthworm-castings seen there in May. A number of these castings were collected on the 7th of May and weighed. The following table shows their weights in grams.

I.	... 19·5 gr.
II.	... 15·5 gr.
III.	... 14·0 gr.
IV.	... 13·0 gr.

The average weight comes to 15·55 grams. The average of another set of smaller castings came to 14·5 grams. The sample of soil from the calcareous area was given to the Agricultural Chemist, Bombay, for estimation of lime. The soil showed 11·76 per cent. of lime calculated as CaO. Another sample of soil, from the area of worm-castings at the base of the Vetal hill, was given for analysis. The report shows a very high percentage of nitrogen. This confirms the belief of ecologists that an area rich in earthworm-castings is also rich in nitrogen and organic matter. A sample of soil collected from the root-zone of *Dipoadi montanum* on the 4th of May showed, after the usual treatment in an oven for twenty four hours, the water-content to be 3·213. This shows that the herbaceous plants thriving in the hot months, must be capable of growing in a soil of very low water-content.

Soil Temperatures.—" To visit the hill at noon time in May is a punishment" said a Professor of Botany in Poona, but it had to be undergone to obtain the maximum temperature reached by the soil in the hottest months of the year. The temperature in the shade was steadily rising from the 18th of May and so 25th and 26th of May were chosen for taking soil temperature, and proved to be quite suitable, as the days were cloudless. On the 25th of May readings were taken from 2 p. m. to 4 p. m. Maximum temperature in shade was reached at 3 p. m. exactly after which, the temperature began to fall. At 3 p. m. the maximum viz. 36°C. was recorded and it gradually fell to 34°C. at 4 p. m. The temperature of the soil at 2 p. m. was 45°·5C. and it rose gradually to 49°C. at 3-10 p. m. and then rapidly fell to 43°C. at 4 p. m. The temperature of a rock on which an *Acacia* plant was growing was taken at 2 p. m. and was found to be 47°C. as against 45°.5C. of the soil at that time. The shade temperature was taken by hanging a thermometer to the stem of *Schrobera sweitenoides*, at a height of four feet from the surface of the soil. The soil temperature was taken by placing the thermometer six inches below the surface of the soil.

Biotic Factors.—A biotic factor affecting soil texture and one which is always known to show a marked effect upon the vegetation, is the earthworm, a species of *Perichets.* The soils at the base of the Vetal hill and the depression near the isolated specimen of Cochlospermum were literally honey-combed, in May with holes ranging from three to six millimetres in diameter and reaching a depth of six feet. In the extremely calcareous area of the 'Burns point', slope and base, and 'Fergusson point', not a trace of earthworms was in evidence. Black soil was noted in certain portions along the base, but only a few earthworm holes and comparatively small castings could only be seen. Large castings and holes were seen along the base of the hill between the Vetal hill and 'Fergusson point' and here the soil was found to be deep and friable. The herbaceous vegetation at these places—examined from June to October—was decidedly richer both in species and individuals, than that seen at 'Burns point' or 'Fergusson point,' where the soil is extremely calcareous. Nevertheless these holes play a large part in the penetration of the soil-water, and it would seem that the additional aeration they make in these fine textural soils are of great importance. Another biotic factor responsible for changing the texture of the soil, is the presence of enormous number of ants. The whole of the east base of the hill is studded with ant-hills, many of these growing round the stems of *Acacia leucophlea.* The effect of this disturbance is that the soil is so loosened in texture that only *Cassia tora*, or a hardy grass alone can grow there.

(*To be continued.*)

The Scope for Agricultural Co-operation in the Deccan.

BY

V. K. Kogekar, L. Ag.,
Divisional Superintendent of Agriculture.

SINCE the starting of the co-operative movement in 1905 the number of co-operative credit societies is increasing every year. The people have begun to realise the advantages of co-operation and its principles are becoming very widely known. Agricultural co-operative societies for purposes other than credit are also gradually coming into existence. In this short article, it is intended to point out what I feel is the scope for such societies in the Deccan, based on my many travels in various parts of the country.

The types of agricultural co-operative societies whose existence is possible in this area is as follows:—

(1) Societies for the supply of pure seeds.
(2) Societies for the supply of improved implements.
(3) Cattle breeding societies for improving the breed of a tract.
(4) Co-operative manure supply societies.
(5) Installations of small cane-crushers to be worked by oil engines on co-operative principles in the sugar-cane tracts.
(6) Societies for the co-operative sale of agricultural produce.

(1) *Societies for the supply of pure seeds* :—The seeds that are generally required by almost every cultivator are those of *jowar*, *bajri*, cotton and wheat. An average well-to-do cultivator generally preserves his own seed of *bajri* or *jowar*, over and above that required for his own food, so that he is in a position to supply some to his neighbours also. The above crops, being also the staple foods, any surplus left, after using the same for seed, can be utilised for consumption. Hence these seeds are easily available and there is also not much demand for them. Such is not the case with cotton seed. To get pure selected seed of a particular type requires a special effort on the part of a cultivator. An average cultivator, even though he may use pure seed, is not in a position to preserve seed from the cotton grown by him, owing to the difficulty of getting such a small lot separately ginned. The practice of getting the cotton ginned on hand gin is still in vogue in some places but this is done to a very limited extent and where large areas are to be grown this is not possible. Thus a cultivator is required to look to others for pure seed and hence the demand for pure cotton seed is always likely to remain on the increase and co-operative seed societies will be the proper agency that can meet such demands adequately. Through the experiments of the Agricultural Department a type of cotton suitable to the northern Bombay Deccan has been decided upon. This is the white flowered, narrow lobed type of *Gossypium neglectum*, commonly known as N. R.

The supply of the seed of this type of cotton in the Deccan Districts where cotton is largely grown, namely in Khandesh, Nasik, Poona, Ahmednagar and Sholapur is of the utmost importance and for this purpose, seed societies to supply pure seed can be started in the two former districts namely, Khandesh and Nasik, at least. In the other three districts named, the area under this crop varies very much from year to year owing to the precarious rainfall, so much so that in a particular year, if the early rains are not timely and favourable, the area under cotton becomes very small indeed. Thus seed societies to produce and distribute seed can profitably be formed in the two districts of Khandesh and Nasik. A beginning has been made in this direction at promising centres.

Among other seeds for which a demand is likely to arise on a large scale is wheat. There are certain tracts which produce good wheat, but if the seed from these places is grown in other parts, it is said to deteriorate owing to adverse climate conditions. In these latter tracts, there is always a demand for good seed, and co-operative seed societies started in the tracts, where good seed is produced, will supply the demand of such tracts. As an example may be quoted, the particular tract in the Ahmednagar district known as "*Kannur Pathar*" which produces good wheat seed. The demand for this seed is very keen in Khandesh and other places.

(2) *Societies for the supply of improved implements*:—The use of improved implements, especially iron ploughs, is becoming more and more extended every day. Well-to-do and substantial cultivators purchase these implements themselves, but it is beyond the power of ordinary cultivators to purchase these, unless they are given on hire. Implement depots have been opened by the Agricultural Department in a large number of important centres, where

the implements are given on hire, and experience shows that such depots if opened by co-operative societies, are also likely to work well. Implement hire societies can, therefore, be started in the Poona, Ahmednagar, Nasik, and Sholapur districts, with advantage.

(3) *Cattle breeding societies* :—To improve the breed of a tract, it would be useful to start cattle breeding farms.

In certain villages we find efforts on the parts of cultivators for improving the breed by keeping a stud-bull for the village, but by keeping a stud-bull alone, the task is not by any means accomplished. After having kept a stud-bull all the bull-calves of one year old and above must be castrated. The stud-bulls must be looked after in the same way as stallions kept at the remount depots are attended to, in the matter of their feeding and exercise. The stud-bull must be given light work for the sake of exercise, for, on account of the want of proper attention to these matters and there being no responsible person to look after the stud-bull, the animal sometimes gets ferocious and becomes a nuisance to the whole village. As it gets no exercise it becomes fatty and thus becomes unfit for breeding purposes. If co-operative cattle breeding societies be started in suitable villages, having good grazing facilities with a stud-bull purchased by the society and a herd of cows formed by contribution from the members, according to their requirements, with a separate herder in charge, this would, I think, be just the thing required. The members of the society would get good work animals for their farming and at the same time they could sell their surplus young stock with profit. There is always a good demand for cattle of good breeds and a bull calf one year old, if of good breed fetches from Rs. 40 to Rs. 60 or sometimes even more. Such societies can be started in Khandesh, Nasik, and in other districts where facilities for grazing and watering are available. There is a great necessity for good cattle and the cultivators appreciate the importance of cattle of good breeds.

(4) *Co-operative manure supply societies* :—Cakes and other manures such as fish, or artificials are essentially required for sugarcane on canals and *bandharas*. If these manures are purchased by a society at places where these are available in large quantities and when the rates are low, the cultivators will get these at low wholesale rates. Such societies will be of great benefit to the cultivators on the Godavari, Pravara, Nira, Mutha, Girna, and Kadava canals and to the sugarcane growers on *bandharas* in the Sinnar, Niphad, Kalvan and Dindori talukas of the Nasik district. A few such societies have already lately come into existence.

(5) *Installation of small crushers to be worked by oil engines for crushing cane on canals and bandharas* :—Owing to the increase in the rate of wages and for want of sufficient labour now-a-days the crushing of cane and other '*gul*' making operations are enormously delayed. As a result of this the crushing of cane is prolonged till June. The cane gets overripe, as a result of which the percentage of sucrose becomes much lowered. The quality of the *gul* produced is impaired and the cultivator is put to a great loss. If therefore such crushing plants are erected on canals and *bandharas*, the crushing operations will be finished in time, the work will be done at less cost to the cultivators, and they will find time to attend to the other farm operations in time. Such plants have been erected already at some places, but there is still great scope for such work on the *bandharas* in the Nasik district in the *tolukas* of Niphad, Kalvan, Dindori and Sinnar, and in the Panjra valley in Khandesh.

(6) *Co-operative Sale* :—Cultivators lose a good deal in the sale of their farm produce. In cases where they are supplied with a particular kind of seed on co-operative principles it will not be very difficult to sell the produce from this seed co-operatively. Thus in the case of N. R. seed supplied to a society, the whole outturn can be sold co-operatively. Thus the cultivators will get good prices and the merchants will get a fixed quality of produce. The co-operative sale of *gul* on the Godavari, Mutha, Kadava canals and in the talukas of Dindori, Sinnar, Niphad and Kalvan of the Nasik district and on the Panjra canal in West Khandesh can be effected thus with advantage.

In addition to the above, the co-operative storage of fodder for tracts of precarious rainfall such as Ahmednagar, the eastern part of the Poona district and Sholapur district, where there is much kadbi on hand in good years, can also be started. Dairy Societies for groups of villages whence milk is sent in small lots to the nearest big place for sale can be started in several places in each district. By the present practice of retail sales by each individual separately, much time and energy are wasted which can be profitably employed in doing useful farm work, if arrangements were made to start small depots in central places in the villages where milk can be purchased from the individual cultivators and thence sent to the city for sale.

Epizootic Pneumo-Pericarditis.

BY

F. Gracias, G. B. V. C.

Lecturer in Veterinary Science, Poona Agricultural College.

A few weeks ago carcases of two fowls were brought to the hospital for post mortem examination. Such bodies are often brought to the hospital usually with a history like the following, which was given in the present case. "The birds were perfectly well last evening, they were quite lively and ate their grain well. They were found dead this morning in the fowl house. Will you please hold a post mortem examination and ascertain, if possible, the cause of the sudden death of the birds? I have lost a good many valuable birds in the last few days."

Fowl Cholera, a deadly disease of poultry, is known to be prevailing in Poona and most of the examinations conducted on the bodies of birds have shown typical lesions of this disease. Such being the case, before opening the bodies of fowls in question, it was thought that the cause of death of these birds was the same, and in fact the owner was told so. On holding an examination, however, no lesions of this disease were noticed, but the very peculiar signs of quite another were seen.

On account of the uncommonness of the disease, the writer not having seen a single case of this nature before, it was thought that a short descriptive note on the subject would not be out of place in the College Magazine.

Definition.—Epizootic Pneumo-pericarditis is an enzootic contagious disease of the turkey and occasionally of the fowl, due to an organism of the pasteurella or fowl-cholera type and is characterised by inflamatory lesions in the lungs and pericardium.

Causes.—The essential cause of the disease is a bipolar staining organism of the fowl-cholera type. It has all the morphological staining and biological characters of this organism and only differs from it by its physiological properties.

Period of Incubation.—The period of incubation ranges from a few hours to a few days, depending upon the mode of infection, and upon the amount of virus innoculated or ingested.

Symptoms.—It is said that birds in prime condition are the first to be attacked and the first symptoms shown are drops of stringy mucus adhering to the beak, peculiar twitching of the eyelids, and stiffness of the neck and legs. Drooping of the wings and tail and ruffling of the feathers are also symptoms very marked in this disease. A peculiar discharge from the nostrils soon appears; this is said to be characteristic of the disease; a gurgling sound is heard from the throat and the mouth now becomes full of frothy mucus. Thin milky white or yellowish stools are frequently passed; the appetite of the bird fails completely and great weakness is experienced by the bird. Sneezing and frequent opening and closing of the mouth are noticed. The wattles may become purple.

Post Mortem Lesions.—The characteristic lesions are confined to the organs affected, viz., the lungs and the pericardium. In the birds that were the subject of the post mortem examination here both lungs showed consolidation and firmness on section. They appeared quite dark and swollen, and the trachea contained yellow flakes. The pericardial lesions were even more attractive. The sac contained a very large amount of lymph exudate with several various sized yellowish fibrinous coagula, the largest being about the size of an eight anna piece. The pericardium was very greatly distended and inflamed. The heart muscle appeared quite pale and the cavities of the organ contained clots. The other organs appeared normal.

Treatment.—Immediate isolation of the sick and thorough disinfection of the fowl-house and yard should be carried out. Burning of the carcases of birds, manure, litter, and even of inexpensive fowl cages is strongly recommended. Protection of valuable birds by vaccination has been suggested. Treatment with the Sulpho-Carbolate Compound may be tried. During an epidemic of this nature clean, wholesome water, containing a few crystals of potassium permanganate dissolved in it should always be given. The birds should be fed with soft food such as bread soaked in milk.

Our Gardening Trip to Gujrat.

BY

K. S. Daryani.

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THE gardening party consisting of Prof. J. B. Knight and Messrs. K. M. Pawar and Bhimbhai Desai from the staff, and myself, Mr. Hardikar and Mr. Tatke from the students, left Poona on 22nd August 1918, by the 3·15 P. M. train.

It is regrettable that the Railway authorities have stopped granting concessions to student parties, owing to which we had to travel by third class, despite the ever increasing rush of passengers, due to the diminished number of running trains.

We arrived at Ahmedabad on Friday (the Fair day) 23rd August, early morning; and we immediately left for the Municipal sewage farm. Here by far the greatest importance is attached to the growth of Papaya cultivation, which pays enormously, in spite of the unscientific methods of cultivation.

Ahmedabad as a whole, however, presented a very sorry sight. The desolate condition of the place, the distressing looks of the Rabaris, the wasting off away the strong and rich cattle was indeed heart-rending. Women could be noticed picking grass which was not even three inches high. All this brought to our vision the pangs of fodder famine, such that the Presidency has not been a victim to before. The outlook is extremely terrible. We can depict to ourselves (if the unfortunate conditions continued) an irrevocable future, a future when we should scarcely be able to find any good cattle in the district—the district which has ever had the reputation to supply the major part of the presidency with milk and its preperations.

One word of suggestion we could give to the Municipal farm authorities, to the Government and to the individual land-lords. And that is that for the sake of humanity, they must, at the present juncture, cast off all the ideas of filling their coffers by the growth of cotton, ginger etc., and leave no stone unturned in raising an abundant supply of fodder. It is a duty, laid down by the Almighty and by the nation, that all the animals should be spared the pangs of starvation;—and many animal are already on the verge of the grave! It is indeed very painful to linger on this point.

We next left for Baroda by an afternoon train, and stayed there for a couple of days, as we went also to the out-stations Vishwamatri and Padru.

We left Baroda for Surat on 25th by a night train, and remained there till the night of 29th August. Every day we used to go to some neighbouring station or village. We studied Utran, Varachha Poona-Kumbaria, Bhattaru and Amalsad. The vegetable gardening here was nicely conducted; and as there is no more room in the present issue, which is already in the press, I propose to deal with the details of cultivation in the next issue.

Our next move was to Bassein where we saw also the fruit gardening and marketing. We left Bassein for Bombay by an afternoon train on 30th August and studied marketing, at Byculla, at 4 o'clock on the next morning. We arrived back at Poona on 31st August 1918.

From Baroda downwards the conditions were better than in the upper part. The fodder supply was tolerable, though by no means abundant; and the condition of cattle at Surat was more satisfactory than it was elsewhere.

While we were carefully studying the gardening problems, we also tried to get some insight in the social and the material condition of the cultivators, which work was very largely facilitated by Mr. Bhimbai. Side by side we found some time also to visit places of general interest, specially at Baroda—the magnificent palaces of His Highness, the picture galleries, the museum, the library etc., of which the latter two were of greater importance from our point of view.

At all the places we visited, we got a very warm and hearty reception; and we made ourselves very free with them in order to be able to knock out all the infomation we required.

In a word our tour was made as interesting as it was instructive.

Obituary.

THE terrible world-Epidemic that goes by the name of Influenza and which has taken such an exacting toll of lives, leaving wide spread mourning and desolation and homelessness behind, has not spared our College.

After the sickness from the 1st wave of the Influenza (mentioned in the College News and Notes) had spent itself, came this frightful second wave ; most of the students, particularly our Burmese friends, who had perforce to pass their holidays in our College quarters, were caught in the all-sweeping infection. They resignedly took their turn of sickness and suffering in bed and recovered. But, we are grieved to note, 3 gentlemen of our College fell fatal victims to the fury of this fell disease.

Dr. Gracias. G. B. V. C.

Born: 11th December 1883. Died 27th September 1918.

He leaves behind a bereaved family. Our tender sympathy goes out to the mourners. A fluent and learned lecturer in Veterinary science, we have likewise lost in our esteemed professor, a good hearted teacher and a man of large sympathies. Requiescat in Pace !

We are sorry that we have to write a note of obituary of Messrs. Gandhe and Moses, students of our College studying in the 1st year. They joined this Colleges at the beginning of the last term and the students and the staff looked forward to them with great hopes.

Mr. Gandhe we are sorry to say, died of Influenza at Indore, where he had volunteered his services for the poor and the diseased in the present epidemic. It is, however, a great consolation that he died a glorious death while helping his poor fellow brethren.

Mr. Moses was an asset to the College and was a good practical and social lad. He had volunteered his services to the India Defence Force and had worked in many social ways.

This College mourns their absence and misses them very much.

May God bless their souls and enable their relatives to bear the incalculable loss they have suffered.

We are extremely sorry to announce the death of Mr. Pandarinath S. Pansare, B. Ag. Mr. Pansare who graduated from our College in 1910 and had since then been serving in the Baroda State Agricultural Department in various capacities. He was a very successful farm superintendent in which capacity he had worked for more than five years. His industrious habits, quiet, genial and sympathetic temperament had endeared him to all and his loss is deeply mourned by all his friends and acquaintances. He breathed his last on the 23rd of August after a short illness. May God rest his soul in peace.

We are sorry to announce the premature death of Mr. B. D. Patel who graduated from this College in the year 1910 and who was taken up by the Agricultural Department in about the same year. He had served the department with great enthusiasm and was always a great source of help to that department.

May God bless his Soul !

Gymkhana Notes.

WE have able and enterprising members on our Gymkhana Committee, to whom we owe our various activities of the past term. The main enlivening features of the Gymkhana activites were, of course, our Cricket Matches and our Debating Society Meetings.

The publication of the Montagu-Chelmsford Report on Indian Contsitutional Reforms was hailed with lively interest by a large body of students. The upshot of all this keen study of the proposals, was the organization of formal meetings of debate on Parliamentary lines : "The Sittings of the House" were presided over by our able Principal Dr. Mann. The arguments on both sides were sound and ably put forth. These unique meetings drew forth all the best powers of the heart and brain that were latent in their owners and so little suspected. For the success of these meetings, we are indebted to the Students' Union.

We wish the College Gymkhana all success for the coming term.

The Debating Society :— The last session was one of the liveliest and fullest on record. We had several distinguished speakers to give us the benefit of their attainments on various subjects. For the choice of speakers and subjects, we are greatly indebted to the worthy secretaries of this most enjoyable Department of the Gymkhana.

Reading Room :—The table is strewn with magazines and papers of all shades of interest and information. The room is frequented at all times and there is a rush and a buzz as each day the Bombay Chronicle arrives.

Cricket :—We have had several friendly matches between the different Colleges with an almost equal dole of success and failure. The first round of the Shield matches was played by our College against the Deccan College on the 17th August. Need we say that the latter were ignominously beaten ? In our second round, the redoubtable Fergusson College Team fell to our lot. We shall briefly skip over the depressing account of this match by attributing crestfallenly our inglorious rout to a "combination of unfavourable circumstances".

Hockey :—Hockey was only waiting for the fall of Cricket to display her charms. Unhappily, the time was not propitious and it seems the stern features of the goddess of Terminal Examinations were more becoming to the large body of young men; be it as it may, hockey could claim but few players and has had a brief life. She will, now we hope, be absolutely irresistible.

Tennis :—Tennis has enjoyed a steady homage and afforded much real joy.

Gymnasium and Swimming:—Owing to want of accommodation, the Gymnasium has been deprived of the facilities it commanded. Swimming is the only form of refreshing exercise that a few busy students are able to take.

College News and Notes.

THE Civilized World has run through more than a quarter of the calendar in its course of appalling travail and misery, since we last reached our readers in our pages.

The iron grip of an overmastering Providence has tightened more than ever on the vitals of Europe ; and the Colonies and Dependencies of the various belligerent nations in the far corners of the earth, on sea and on land, are feeling, in varying degree, the waste of their life-blood. We, out here in India, at this enormous distance from the actual fighting zones, are feeling, in increasing measure, the weight of the heavy hand, in the form of prohibitive prices of all the articles of necessity and luxury to man ; and the gloom of the cloud of death has fallen over not a few homes, in this land of the sun.

As if the suffering of man from this ghastly war alone, were small, the very elements seem to have conspired together against him. Rain, the universally coveted grace of the Gods, has stayed away from Indian soil, many a time before in her checkered history, and the country has groaned. But what shall we say of the touching wail of woe that is rising to-day, in wave upon wave, from countless stricken homes? The land of middle India is parched and shrunk, in its gaping agony, and the husbandman misses the beloved green of his fields and pastures.

Indeed man realises in his adversity, that if progress and material advancement are in his hands, life and all vital issues rest with one infinitely above him ; he realises that, after all, the life of this world is not all.

All through the past months, we students of this College, have earnestly joined with our fellow brethren the poor "*ryots*" in prayer and hope for rain ; but rain has not come ; we have not ceased to pray with them yet, and we have not ceased to hope ; even as we are writing this, (somewhere in the Southern Maratha Country), the people's prayer seems to have been answered by a kind Providence and the few heavy showers we have just had have been welcomed with humble gratitude. Once more, one sees that mortal man is blessed with a boundless capacity for hope.

The students of the second year have been more directly affected by this holding back of rain; for they have had to raise their crop, in spite of that, and it has been a usual sight to see them bustling about, wet and dripping (from two sources) with great buckets full of water that seemed to be dangerously near pulling their arms out of their sockets.

Two epidemics, first " mysterious influenza " (?) and on its heels a virulent attack of cholera have run their course through all parts of Poona at the same or different times, during the greater part of our last session at College. Many of our students were touched by the first of these epidemics ; but—and it is a matter to be grateful for—cholera has swept by through our midst without claiming a single victim to her black skirt. To Dr. Mann and other gentlemen of the staff, we, students have been not a little indebted, for the wise counsel and ready solicitude, with which we were armed and shielded by them against this inglorious foe of mankind.

Not a trifling land-mark in the records of our College News and Notes will be, what we had on the 8th of August last. The opening ceremony of the Union Agency Potato Works and Exhibition of Potato Seeds and Manures. We have mentioned this elsewhere in our pages, but its place among the News of the College cannot be overlooked. The works have been housed in *kachha* buildings at no small cost. They are to be replaced by " scientifically designed *pucca* ones" as the works grow. Twenty-five thousand rupees have been spent by the owners on organisation and research alone. The Exhibition was a big success and afforded much material to students for discussion ; in its honour, the students solicited a holiday and got it. It will be remembered by many as the "Potato Holiday."

As the outcome of Dr. Mann's constant efforts, we have at last secured two extremely roomy blocks from the Hospital Authorities. They are of temporary erection, but with slight alterations for convenience, promise to suit our requirements for lodging, tolerably well. From next term therefore, one of these blocks will accommodate a large number of students, and afford many a convenience that they have for these last 2 years and more, uncomplainingly gone without. The other equally long and spacious block will remain ready at our disposal, for College use.

The handful of B. Ag. men that are specialising in vegetable gardening, had a jolly tour of ten days to Ahmedabad and other places in Gujarat winding up with Bassein and Bombay.

We are proud to note that of a few of our students that applied for "Temporary Commissions for Indians", Mr. Shinde was selected on the nomination of His Excellency the Governor, to proceed to Simla for medical and other test-examinations; we trust he will be given the King's commission: To others, who had disappointment we offer our sympathy.

We are glad to find Prof: G. K. Ranade back in our midst after his 3 months sick leave.

We were all sorry to find Prof: S. S. Godbole taken ill at College one day ; he had been ailing these several months but his high sense of duty to the College (and he had many duties) would not permit him to give up his work until the other day. We trust he will make the best of his well-earned leave towards regaining health and coming back to us once more himself. Mr. N. V. Kanitkar took his place with admirable success. Mr. V. G. Patwardhan took the place of Mr. Kanitkar in the Chemical Laboratory for students ; he has become better known to us, in his new capacity.

In closing, we offer our best wishes to all students and members of the staff for the new term. The second term is certainly a very busy time but then it is tinctured with spells of genuine enjoyment,—we refer to our Annual Sports and Social Gathering, and to the various tours.

May our College beat all previous records in the Annual Examinations this year.

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THE
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AGRICULTURAL COLLEGE
AGRICULTURE THE FOE OF FAMINE
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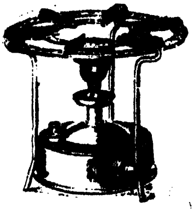

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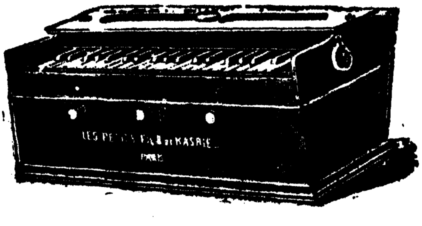
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Mr. Arthur Sullivan.

THE POONA
AGRICULTURAL COLLEGE MAGAZINE.

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EDITORIAL.

AS we issue the present number of the Poona Agricultural College Magazine, a very large part of India is in the grip of a very severe and serious famine. And of all portions of the country affected, the Bombay Presidency is on the whole the worst. In this province there is hardly a district which has had a normally successful season. In the south, the Dharwar district is probably more near the normal than any other, but even here, the western part has had a disastrous year. The worst parts of the Bombay Presidency lie in two tracts. The first, and perhaps the worst, includes the Ahmednagar district as its centre, and a large part of the Poona, Nasik, and West Khandesh districts; while parts of the Satara and Bijapur districts are nearly as serious. The second tract in which famine is very serious lies in Gujarat, and includes the northern part of the Broach district, and all the province to the north of this. In Ahmedabad, Kaira and a very large part of Kathiawad conditions are truly terrible at the present moment, and the prospect, at any rate as regards cattle, is truly gloomy. The area affected is perhaps greater than in any famine of which we have accurate records.

The seriousness this year is due to the fact that the failure of rain found the country with stocks of both food and fodder already seriously depleted, on account of the war demands of the last three years. Prices were high, stocks were low, and then the rain failed. Even the stocks of fodder collected by the agricultural department had been taken away for use in Mesopotamia.

Under these circumstances the work of the Agricultural Department is very wide and important. With famine relief, of course, it has nothing to do, that is cared for by the executive department of

Government. With the supply of grain and fodder from existing stocks the agricultural department has likewise nothing to do, that is under the charge of the Director of Civil Supplies, and he is responsible for seeing that each district is supplied with the grain that it needs, so far as is possible, with the import of grain when it can be obtained, as rice from Burma or wheat from Australia. He has also organised the distribution of the fodder supplies available, whether from such stocks as exist, or from forests and similar sources. But the Agricultural Department is responsible for seeing that new and unusual resources of fodder are used to the utmost, for seeing that existing water supplies, as those existing in rivers, are utilised as far as possible, for the production of fodder, for increasing the supplies of water in wells by boring as far as can be done, and for utilising any and every possible resource to increase in particular, the fodder supplies of the country.

These activities have been undertaken with enthusiasm. Since famine became certain, all the engines and pumps belonging to the Agricultural Department have been taken and fixed on suitable sites, chiefly on the banks of rivers, where cold weather and hot weather fodder can be grown. Before another famine occurs it is important that a survey of suitable sites for these should be made, but a large number of such engines and pumps are now working, and between two and three thousand acres of land are being irrigated with fodder crops. Much of this land will bear two crops, but even counting one crop only, it will mean at least three hundred lakhs of pounds of green fodder alone during the present hot weather or enough to keep 10,000 cattle throughout the present season.

The use of prickly pear as a fodder to eke out the supplies of fodder available was introduced in the Ahmednagar famine of 1911, largely through the enterprise of Mr. Norton of Dhond. The investigations of the Agricultural Department at that time showed that this material can be used as a fodder with great success, provided the thorns are *thoroughly* burnt off and provided with a quantity of this material, *kadbi* or cotton seed, is given at the same time. For burning the thorns, an ordinary fire was found to be no good, the intense flame of a blast lamp being needed. Since the present famine commenced, a blacksmith's forge has been found to be equally efficacious but the necessity for the thoroughness in burning, has been proved, as otherwise the cattle die. Mr. Norton has, this time, fed prickly pear alone without addition, but it seems doubtful how far this method will be generally applicable. But, either by providing for the cattle in cattle camps with prickly pear, or :by showing the use of the material, prepared with the blacksmith's forge, in the villages it is expected that this time, prickly pear, will play an important part in the fight to preserve cattle during the coming six months.

There are other unusual sources of fodder which may have a limited use. Plantain stems are capable of being fed, and are now being used. The leaves of trees, even *neem* and *banyan* are being employed. The leaves of certain varieties of mangrove and other plants in the creek along the coast are now utilised, and wherever such resources exist, every effort is being made to use them and make them known. Even the chaffing and carrying away of *jowar* stubbles, where these are allowed to remain long as in the south Surat district, is being considered as a means of supplementing the present unprecedented scarcity of fodder.

Every effort is being made to use the wells of the country for growing crops. As early as September last, money was advanced, to put wells in order, to maintain cattle while fodder crops were growing, and every help was given in the way of advice and assistance. As a result very many wells were brought into use which had not been employed for years. And while very many wells which might well be now the means of irrigating crops are even now unemployed, yet many thousands are being worked for all they are worth, and are, however failing and here, particularly in Gujarat, is the opportunity of the boring machine. Nearly all the fifty or so boring plants belonging to the Agricultural Department are now concentrated in the famine districts for this work, so that standing crops can be saved, and new ones planted. Some of the fodder crops grown this year have been magnificent on wells which have hardly been used for years. And generally speaking the area of fodder crops, and of none more than of Lucerne, has been enormously extended in the present season.

Another line, not yet developed, but which may attain considerable importance later in the season, is the protection of standing crops from wild animals, particularly wild pigs. But it will be better to refer to this when more developed.

By these various activities a very large number of cattle will be saved. The mortality will still be tremendous, probably at least one million cattle out of a total of seven million will inevitably die, and it is quite likely that the number may be much greater than this. But we have got to save what we can.

So much for the work of the Agricultural Department during the famine itself, it will have a great work to do in the period of reconstruction which will follow, when every effort must be made to bring back normal conditions as quickly as possible, and prevent the possibility of another famine so far as it can be done. We hope to give some account of its intended work during this period in our next number.

"Protection of Cattle during the Famine."

BY

V. V. Gadgil, B. Ag.,
District Agricultural Overseer, Ahmednagar.

THE failure of monsoon and the subsequent rains, has given rise to a critical situation throughout the Presidency and we have been threatened with a very serious shortage of grain and fodder as was never experienced in any of the Past famines. In the recent Press note, it has been stated that the prices of good grain in the height of severe past famines ranged from 17 to 30 pounds per rupee, whereas, at present the average price of grain is 8lbs. per rupee. The situation of fodder is much more critical as a large stock of reserved fodder has been already supplied to the Expeditionary forces dependent on India. In the famine-affected tracts, fodder has become almost scarce and it is impossible even for the Government to supply the full requisition of the cultivators. The following figures will show the abnormal rise in the prices of fodder during this famine in the Ahmednagar District :—

Name of fodder	Price in normal years per rupee.	Price in the current season per rupee.
(1) Karbi	125 lbs.	12 lbs.
(2) Grass	200 lbs.	not available in this District.
(3) Green Lucerne	250 lbs.	40 lbs.

The Government are trying to take some measures to supply a small quantity of grass at concession rate of Rupees 15 per 1000 pounds, but the quantity is so inadequate when compared to the requisition of the District, that it will be hardly sufficient to meet the demand of even a small Taluka of this District. For instance, the Government are supplying 50 lacs of pounds of grass to this District in 10 months which would be only sufficient for 1000 cattle while the District contains more than 4 lacs of cattle. The percentage of the protected cattle thus comes to 0·25. To add to this evil, the restrictions on the Railways have made the transfer of fodder from one place to another almost impracticable. As a result, a large number of cattle is daily being disposed off at a ridiculous price which is even far lower than the cost of their hides and bones. In every cattle-fair we see thousands of cattle sold to butchers for 2 or 3 rupees per head and if this live-stock is lost once for all the cultivation of land will be a serious problem in the next season. Indian Agriculture solely depends upon cattle power which is the only capital now left with the cultivator. If a cultivator suffers from want of food he can safely desert his village and go into the towns and cities where he can earn his livelihood. But the poor dumb cattle have no other alternative than to die of starvation. It is therefore the duty of every human being to protect the life of cattle even at the maximum sacrifice.

Let us see what measures had been adopted to protect the cattle during the last famine. In the year 1912-13, there was a severe famine in the Nagar District. But as the area affected was comparatively small and as the surrounding Districts were well off, it was possible to secure adequate fodder from the surrounding tracts. The cattle relief committee of Ahmednagar secured large funds from some philanthropic persons in Bombay and thereby opened 6 cattle kitchens in which the plough and milch cattle were supplied with fodder free of cost for nearly 8 months. This committee had protected nearly 4000 cattle of the helpless cultivators. There was another association of the Local Merchants (Marwaries) which had also rendered very valuable service in supplying free Karbi and cotton seed and admitting a large number of cattle to the *Panjrapol*. During that famine, the scarcity of fodder did not much crop up and it was only a question of organisation for raising a sufficient fund to open cattle camps on philanthropic basis. One of the most useful experiments conducted in the cattle camps at Lakh, Miri and Nagar, was the use of prickly pear as a famine fodder. This experiment has attained a fair success and the public is now convinced that it is possible to maintain the life of an animal with the neglected cactus with a little addition of some concentrated food such as cotton seed, oil-cake etc. The cost of maintaining the animal with this food came to annas 2½ per head per day, or roughly, Rs. 4-12-0 per month. Most of the cattle were without work during the famine days. The nett cost of maintaining one animal for 7 months on prickly pear came to Rs. 30.

During the last famine the cost of labour, fodder, cotton seed, oilcake, Kerosine oil and Blow lamps, was much cheaper when compared to the present market prices and hence it was possible to feed the cattle partly with grass and partly with prickly pear. But in the present season it is impossible to secure fodder in large quantities and the Relief Committee will have entirely to depend on the use of cactus.

Another important point is the contrast between the prices of animal in the past and the present famines. In 1913 an ordinary bullock was sold for at least 20 to 25 rupees while at present it fetches only 3 or 4 rupees. In fact there are no purchasers in the market except the butcher. Under these circumstances, it is a matter of prime importance for the Relief Committee whether they should continue their cattle relief in their old ways or whether it is possible to devise a means of protecting cattle on the combined principles of profit and philanthropy. To my mind the 2nd method is more feasible in which the attention of the public bodies is better concentrated. Instead of opening cattle kitchens for free feeding, the Relief Committees should arrange to purchase all the healthy and useful cattle from the markets and they should be fed on cactus in suitable localities. As stated above, the price of such cattle will not be more than 6 or 7 rupees per head and the poor cultivators will be more glad to hand over their dearest cattle to the agents of the Relief Committee than to sell the same to butchers. These animals will then be the property of the Relief committee who can protect them by any means. This will also eliminate a large number of cattle of the well-to-do cultivators who are really in a position to maintain their herd as they would be quite reluctant to part with their cattle. The responsibility of the Relief Committee would also be lessened if unfortunately some animals succumb in the experiment. The cost of maintaining 100 cattle with prickly pear for 6 months is given below :—

Upkeep of 100 cattle with prickly pear for 6 months.

Rs. 800	Initial cost of 100 cattle to be purchased from the cattle fairs. (This item is likely to be reduced if the idea of protection of cattle be brought home to the cultivator).
Rs. 350	Price of 6 Blow lamps which are very costly at present. It is believed that the Government is willing to supply Blow lamps to such cattle camps and hence this item will be left out of consideration.
Rs. 600	Wages of 10 men for 6 months, required for preparing the prickly pear and also for watching the cattle.
Rs. 1500	Cost of 25,000 lbs. of cotton seed required during the 6 months.
Rs. 350	Cost of Kerosine oil required for preparing 3000 lbs. of prickly pear per day for 6 months.

Rs. 300	Cost of grass required at the beginning i.e., until the cattle are accustomed to eat the cactus, to be purchased from the Government Depots at concession rate of Rs. 15 per 1000 lbs.
Rs. 25	Cost of salt required for mixing in the prickly pear.
Rs. 75	Sundry expenses such as ropes, pins etc.
Rs. 4000	Total.

This is the most liberal estimate and a shrewd manager is sure to reduce it by 500 rupees. Besides, if the cost of blow lamps and a part of the initial cost of the animals be deducted from this estimate, it will be within the reach of even a village society. No housing is required for these animals and the only precaution necessary is to select a camping ground where water and prickly pear will be available in large quantities. After the famine is over the return of 100 cattle is expected to be between 4000 and 5000 rupees as there would be a keen demand for agricultural cattle in the next season. If similar camps be started viz: in every prominent place of this District the famine foe is surely to be defeated by human efforts.

At the time of submitting this note, I come to know the results of Mr. Gopal Ahir Gavali of Nagar who was induced by me to utilise the prickly pear fodder for his milch cattle. The experiments have been started from the middle of December 1918 and the results of the last 3 weeks are very encouraging. He has got 50 she-buffaloes and 10 cows which required 50 rupees worth fodder daily. But since the substitute of cactus for fodder, he is daily saving Rs. 20. His percentage of concentrated food is a bit higher but it is very remarkable that there is not the slightest reduction of the milk yield since the commencement of the cactus experiment. On the contrary, the lean cattle are becoming more active. The ration given to these animals is given below:—

1.	Cactus	30 lbs.	per head.
2.	Cotton seed	4 lbs.	do.
3.	Oilcake	2 lbs.	do.
4.	Husk of safflower	2 lbs.	do.
5.	Salt	2 ozs.	do.

Grape-vine Pruning in India.

BY

G. B. Patvardhan, B. Sc., F. R. H. S.

Assistant Professor of Botany.

IN the Deccan, grape-vines are planted by two classes of people. The first class consists of those who cultivate them on a field scale by planting from 300 to 2000 vines under proper orchard conditions. These people grow them for profit and do therefore attend to all operations as matters of necessary and regular orchard routine and in consequence, know pruning which they perform in proper time. In contrast to them, there is the other class of people, namely Jahgirdars, substantial Land-holders and others among whom may be included Managers of Municipal and Native General Library and other public gardens who plant a few vines, at the most a dozen of them, either in compounds of houses or in any odd corners somewhere near a well, in cultivated fields or gardens. They plant them with no plan of ever giving the right sort or for the matter of that, any sort of cultivation to the vines except irrigating fitfully or perpetually. They expect the plants to return them beautiful bunches under the conditions mentioned with the result that the plants often times grow rampant for several years without fruiting, and thus bringing disappointment to their owners who may happen to remember to look at them after the lapse of a long time since sticking them into the ground. Such people should realize that the grape-vines must be pruned if they have to give fruit. The writer has pruned many such rampant vines with the result that they made a wonderful response by fruiting abundantly. In order to render the benefit of his experience in this matter, the following lines have been written with a hope that they will be best utilized by all interested in Viticulture.

Pruning means cutting away of branches or shoots which are considered unserviceable to plants or are useless on them in view of the object the operator has to attain. It includes pinching of tips of main branches and laterals. Disbudding, i. e. removing buds, may also be included in the term. The purposes for which grapes are pruned are:—

(1) to obtain a form of the vine in conformity with a definite scheme of *training* elected by the vineyardist.

(2) to regulate, in the early stages of the life of the plant, the flow of sap towards the tip in preference to its diversion or distribution towards the laterals.

(3) to attain increased vigour in the plant; for, by cutting off a portion of a shoot or branch, the sap that would have been diffused over the whole is concentrated on the part left and hence increased vigour is obtained by the parts left.

(4) to obtain fruit, not only fruit, but fruit with the best desirable characters, say, an increased yield of it or large bunches. The act of pruning assists a good deal in the production of fruit. Pruning is a necessity in the vine plant if fruit is wanted.

(5) to check rampant growth which the vine plant is addicted to produce.

(6) to stop the vine growing any further than over the extent of space allotted to it by the method of training adopted by its grower.

(7) to maintain the hygeine of the plant, as in removing dead shoots, or wood, bark &c.

(8) In the early stages of the life of the plant, pruning is resorted to, that we may secure shoots that will be useful for a definite mode of *training*.

While dealing with the details of *pruning* some reference to Training of the vine is unavoidable. Therefore it is necessary to understand what is meant by Training. Since the vine is naturally a climber, it must be provided with a support to enable it to climb up and carry its leaves and branches higher up in the air. It will not often bear fruit if left to spread on ground. Nay, it even refuses to grow well if not given a lift.

Training consists in supplying it with a support and fastening its shoots, arms, spurs &c. in such manner as to obtain the best results. Spreading the young or ripened branches and tying horizontally or otherwise is also included in the idea of Training. It is to regulate the shape which the vine shall assume in order to give the best results. There are several systems of training adopted by a vineyardist with different objects in view. The subject of training is complicated. It will be out of place to explain it at length here. But it must be mentioned that among the objects for which we prune, training is also one, *i. e.* sometimes we prune in order to train the vine. It must also be mentioned that the vines in the Deccan are trained on two systems. One at Nasik is the *Single Stake* system and that at Satara and Junnar *Four Single Stakes* system. The two systems are really one and the same for purposes of pruning. The former system only is meant in the detailed account of the stages of pruning explained further on.

When reading literature on grape-vine, the Indian mind is much confused over the terminology used in American, English and Australian books. The technical words in vogue explain the operations and parts of plants as applicable to the cultural conditions obtaining in temperate climates. Consequently, it is difficult to extend their correct application in this part of India. In order to explain pruning and training, I have adopted the following definitions of the technical terms to suit the cultural conditions and the growing seasons of the plants as noticeable in the Deccan.

(1) A *shoot* is the new green growth of the season.

(2) A *cane* is a ripened shoot of the past season.

(3) That portion of a cane which is left behind on the vine when pruned is called a *spur*.

(4) The spur about 5 or 6 inches long, bearing 3 or 4 buds which is obtained by pruning in October is a *Fruiting Spur*.

(5) The spur bearing one bud which remains at the April pruning is called the *foundation spur* as it forms the foundation of wood on which next year's canes and fruiting spurs will be formed or on which both growths of the year are borne. It may be called *renewal spur*.

(6) The main stem of the plant is called the *trunk*.

(7) A *rod* is that portion of a pruned ripe shoot carrying more than 5 buds. It may be called a *long spur* and may then bear 10 buds or more.

To understand the above, it must be realised that, in the Deccan, the grape-vine has two main seasons of growth in the year; one commences in April and the other in October. The vines are pruned twice in the year, once in April and again in October just before the forthcoming flush of sap.

(8) *Summer shoots or First growths*:—All growths or new shoots which appear and grow after April pruning *i. e.* between April and October.

(9) *Winter shoots or second growths*:- All shoots or new growths which appear and grow after October pruning in the period between October and April.

(10) *Laterals* are *side shoots* growing on shoots of the season.

(11) *Secondary laterals* are growths produced on laterals in the same season as of the laterals themselves.

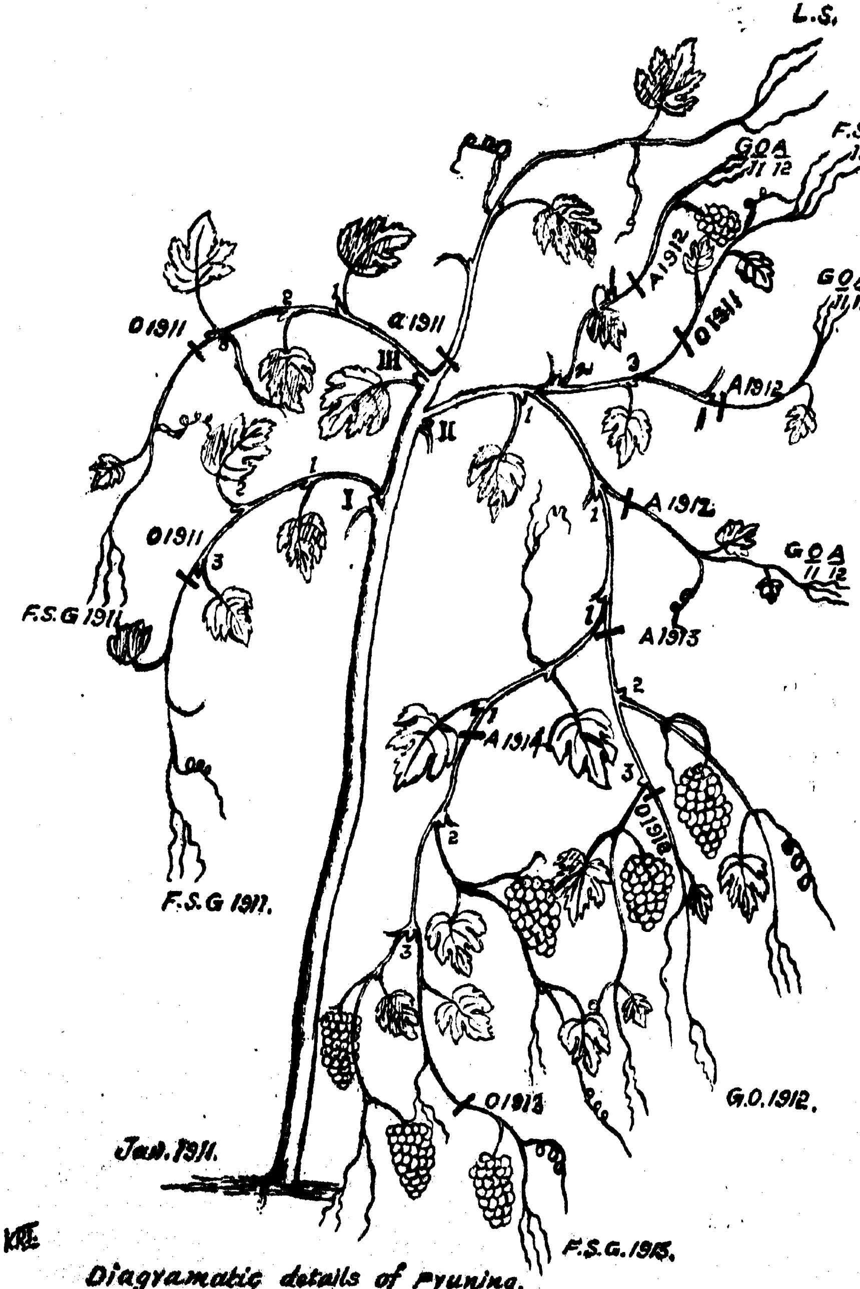
The cultural conditions referred to above, are concerned with modes and times of pruning only. In temparate climates, there is only one season of growth in each year, while here we have two principal growing seasons. Although we find new shoots appearing on the vines oftener than twice, depending upon the irregular and frequent appearance of short and long, wet and hot periods in the year. Hence the vines must be pruned two times in the year and a crop of fruit appears after each pruning. In temperate countries the vines are pruned only once in the year. The pruning, as a matter of course, is adapted to the particular growing seasons and the explanatory terms also presume the conditions obtained in those climates. Hence there is a considerable difficulty in correctly applying the technical terms in vogue on grape pruning to the conditions obtaining with us. I have therefore felt the necessity of giving special significance to the terms, so that details of pruning as practised by us in the Deccan, may be easily intelligible to those unaquainted with them. In order to understand Grape-vine Pruning, one must realise at the out-set the most important fact that "*All intelligent pruning of the grape vine rests upon the fact that the fruit is borne in a few clusters near the base of the growing shoots of the season which spring from the wood of the last season's growth*". Shoots proceeding from the wood of any other age will not bear.

Pruning in the Deccan.—Now I shall explain the actual method of pruning of a vine from its infancy, as practised under Deccan conditions. (The years given in brackets will indicate the stage in the life of a plant).

Well rooted cuttings of vines are planted in their permanent quarters in January (say 1911). The much desirable practice of pruning away at planting time all the tender portions of the rooted cutting and retaining only one or two buds on ripe portions of wood close to the ground is not followed here. The cuttings are planted as they are, with tender shoots. The removing of the parts mentioned, is really beneficial and should be recommended. In course of proper time, the buds will sprout up into one or two shoots. Retain the stronger and remove the other. This shoot will soon begin to throw laterals. Remove the laterals the moment you see them. You must look out for them very often indeed. Rub off all lateral buds on the vine from time to time as the stem progresses in height, retaining always the top or leading 3-4 buds. This treatment will hasten up the vine to a height of 5 or 6 feet in the course of 3-4 months since planting (say, from January 1911 to April 1911). During this period, the vine must be fastened to a thin, dry, erect stick. Then in the first season's growth, retain the top 3 or 4 buds and let them branch out laterally but do not fail to remove any new growths or buds that might appear down below during this period. In April 1911, pinch the leading shoots. Let the lateral shoots proceeding from the above mentioned 3-4 buds grow on till October (1911), that is, until 9 months after planting the vine. Meanwhile a live support of a Pangara (Erythrina indica) stump about 8 feet high must be planted near it in May or June, to which the vine must be fastened, the original stick, planted in January as support in the very tender stage of the plant, being removed. In October (1911), pinch the tips of the 3-4 laterals to a point of ripeness on them, *i. e.* to about 3-4 buds *from the base of the shoots.* Let all shoots which emerge from these buds (*i. e.* from the ones left on the spur) grow. These new shoots will form canes till next April (1912) *i. e.* 15 months since planting. Now (in April 1912), cut these canes to foundation spurs of one bud only. Let this bud grow out into a long shoot till October (1912) of the year (*i. e.* 21 months since planting). Now retain three buds on the ripened and basal region of the shoot of the first growth and prune. In November (1912) or December (1912) of this year *i. e.* 22-23 months from planting, a few flower clusters or bunches may or do appear, but these are removed. Remove the clusters and let the growth proceed upto next April (1913) *i. e.* 27 months since planting. Prune now in April (1913). Retain one basal bud—the one that had remained dormant in the period between October (1912) and April (1913) on the shoot which was originally the *first growth* of the year *i. e.* from April (1912) to October (1912). This pruning will take away all the *second* *growths* formed in the previous season *i. e.* from previous October (1912) to April (1913), together with the two front buds on the first growth *i. e* from April (1912) to October (1912) and retain only one dormant rear bud on the latter. This pruning will provide the foundation spur or renewal spur for the forthcoming *real* and *first* crop of fruits. After this, let the first growth of the year (1913) proceed and ripen, to be pruned back to three buds in the next October (1913) *i. e.* 33 months since planting. The second growth coming here-after will bear flowers which will ripen to marketable bunches in February-March (1914) *i. e.* 36 months since planting.

In the above lines, the stages of pruning are carefully traced right from the date of planting to the end of the first cropping. The perusal of the details may become dry and tedious to some, specially to those who cannot have patience enough to go over it with care. If the reader draws a sketch in close pursuance of the details, remembering during perusal the definitions given in the earlier lines, he will then very easily grasp what is explained and will be able to operate without a mistake.

The system of pruning adopted in the last 12 months referred to above, should be followed from year to year throughout the life time of the plant. Two prunings are done, one in the first week of April and the other in the first week of October. At April pruning *one* bud is retained on the shoot which by that time is one year old and which had had a pruning in previous October and which bore all growth including fruits which appeared in the interval from October to April. At October pruning three buds are retained on the ripened shoot which had grown in the period from previous April to date of pruning. In the former, we get the renewal spur and in the latter, the fruiting spur. To make the point clearer, I put it in other words. There are several canes at the end of September, the number varying according to the nature of growth, and the pruning done in previous seasons and the vigour of the vine for bearing fruiting branches at the top of the vine. These canes are cut back to 3 or 4 buds in October pruning. Two or three of these buds shoot forth giving bunches of fruit. At the same time the rear bud has remained dormant *i. e.* it has not burst into a fruit-bearing branch like its front fellows. At the hot weather pruning, they (the branches) are shortened to the dormant bud, the fresh shoot from which will form the canes for the next October pruning. The accompanying diagram explains all details as outlined above.



Diagramatic details of pruning.

Sometimes, or rather, very frequently more than one shoot appears from the dormant bud or from an unseen bud close-by. One or both or more of such shoots will be kept on and used for formation of canes as may be required.

The above lines if carefully followed will provide the method which should be adopted in succeeding years.

It should be added that at every pruning one finds a spur—a foundation spur here and there dead or dried up. Such spurs should be scrupulously removed so that the head of the vine will be less crowded than otherwise and therefore less subject to harbour insects seeds of fungus diseases.

As a result of the method of training and pruning explained, a crown of spurs is formed at the top of one stem about 5 feet high. This crown of spurs forms the *head* of the vine. The training adopted is called the *Single Stake* system. In this, the crown of spurs or the head of the vine never expands more than 2 feet in diameter even in 20 years.

In order to make the subject of pruning easily intelligible, I have recommended, in the foregoing description, the retention of only 3 buds on the spurs at October pruning, but the length of the spurs may be extended by another bud or two, if the well ripened region of the basal portion of the cane is sufficiently long. The length of the spur may be shortened to two buds only if the ripened region is shorter. Similarly the spur retained at April pruning, is to have only one bud *i. e.* to the length of only one internode. But it may be cut into two, if a slightly longer spur is needed in order to prevent much interlocking with adjacent spurs or shoots growing therefrom or growing from back buds. Or the spur may be cut back right close to the main stem. Modifications to this extent are admissible but no further. Sometimes the whole length of the fruiting spur or foundation spur dies away either on account of overcrowding or by the loss of buds eaten by the beetle (scelodonta strigicollis) Such dead parts should be removed at the time of pruning. Besides older spurs which interfere with each other should also be cut away.

Summer Pruning:— In the period of the second growth, the tips of the shoots should be pinched away at about the 4th leaf beyond the bunch on it. Many cultivators do not perform this operation, but it is a mistake. Intelligent Bagwans who buy the season's crop in advance do it and they get the benefit in the formation of larger berries. It is also necessary to pinch away parts of laterals and sub-laterals emerging in the season.

Pruning in Madras:—Here grape-vine cultivation does not seem to have received any scientific and experimental attention at the hands of either the people or the Government. Nor have the indgenous agriculturists paid any regard for extending grape-vine cultivation in the province. It is, therefore, no surprise that we find a meagre reference to grape-pruning as practised in a small garden at Penukonda in the Madras Agricultural Departmental bulletin No. 57. "The operation called in Telugu '*Kasaru teesedi*' which consists chiefly in pruning the creepers and the roots is then (*i. e.* in January) performed." "All dried portions of the vine should be cut off at the time of weathering". One annual pruning is done. If the vines were cultivated on a field scale, I suppose, that in this Presidency also two prunings done in the manner and at times as in the Bombay Deccan would improve the cropping ability of the vines.

Pruning at Peshawar:- Exactly twelve months after planting strong canes are slightly cut back and weak ones are severely shortened. In each case laterals are cut to one or two buds from base. The second pruning is done exactly 24 months since planting and fruiting follows this pruning, the bunches being borne on shoots of current year only. The third pruning is done in the third year. The tangled masses of shoots are cut back to the *main rods*. Laterals on the rods are pruned annually to within half an inch of their bases. After the vinery has once been established in the first three years, it is pruned only once in each year, in February. The main rods are retained and each annual growth that has borne fruit is cut back to one or two buds close to the point of origin near the main stem or arm.

Pruning in Sind:-There is a certain extent of grape-vine culture at Karachi, Hyderabad and Mirpurkhas, though not on a field scale as in Deccan. Here the pruning is practised on the system in vogue in temperate climates and it suits the plants quite well so far as the writer's observations go, but still it is considered that there is certainly some opening for improvement.

Two points must be noted in the method of pruning. *First* only one pruning is done in the year in the month of February and *Second* the fruit is borne on last year's growth. The long shoot which has borne fruit is cut back leaving 5 or 6 buds on the cane from the bottom. The growths from these 5 or 6 buds are again pruned the next year and so on. The spur or rod of the vine lengthens from year to year and the fruit-bearing part is pushed ahead every time. After some years the rod of the vine is shortened back by pruning close to the main arms.

Pruning in Bangalore:– There are some vines cultivated here. They are pruned twice in the year just in the same manner as we do in Poona or Nasik and also at the same times viz. in April and October. The *Sultana* grape vines are pruned leaving 16 buds for bearing.

Sweet Potato as a famine crop.

By

N. V. Kanitkar, B. Ag. B. Sc.,

Acting Assistant Professor of Physics.

THE village of Jategaon Budruk in Sirur Taluka of Poona District is situated in a tract of precarious and uncertain rainfall and the cultivators of the place are not altogether unaccustomed to the conditions of famine or scarcity. And hence when there is the failure of monsoon rains they try to adapt themselves to the changed conditions. Many of them, especially those who have no irrigation facility, leave the village and go out for work. Those that remain behind try to raise such crops as are likely to save the lives of both men and cattle during the famine conditions.

The cultivators recognise as a result of experience of the past years that the crop of sweet-potato stands in the front rank as a crop which will enable them to obtain enough food for themselves and their cattle during the period of famine. And every possible well is repaired and utilised when the rains fail.

In most cases there are partnerships in the well and all the partners try to take advantage of their share in the use of the well. At the time of my visit to the place in October last, eighteen wells had enough water for irrigation and out of these sixteen wells were utilized for irrigating some area under sweet-potatoes.

The area under sweet potatoes irrigated from each well varied from one fourth of an acre to two acres, according to the capacity of the well and the presence or absence of some other plantation of a permanent nature like the orange plantation. The following short account about the crop and the method of cultivation in practice at the place may be found useful.

The soil in most cases is medium black, more or less shallow with *murum* below.

The land is ploughed with the Kirloskar's Iron plough No. 100, in the month of September or October. Farmyard manure is then spread on the land to the extent of about forty cart loads per acre. A second ploughing is now given with the wooden plough which mixes the manure. The breaking up of clods and the levelling of the land is then done with the head piece of the harrow without the blade. After the land has been thus levelled the wooden plough is used to open up furrows at a distance of about eighteen inches. The land is then divided into square beds with the size of 7½ feet × 7½ feet. Thus there are nearly eight hundred beds in an area of one acre.

Water is now turned on to these beds before planting. The cuttings nine-inches long which are locally obtained, are then planted half way on the ridges on both sides of the ridge. These are sold at a high price and the cuttings necessary for planting an area of one acre cost ninety rupees. Five or six days after planting watering is given and then every 10th or 12th day according to the possibility of obtaining water.

Six men or women would require eight days to plant an area of one acre.

A month after planting, the first weeding is given and another at the end of the second month ; two months after planting the stems are raised up to prevent rooting.

The crop is ready for harvest in four to four and a half months. One man is able to harvest five beds in one day.

In most cases however the crop is grown for home consumption and when a family consists of not more than five persons they harvest only one bed every day. This gives an out-turn of ten to twelve seers or twenty to twenty four pounds. This quantity is ample for a family of about five or six persons. The creepers are fed to the cattle as fodder. Creepers from five beds are necessary for a pair of bullocks for one day.

We cannot have an exact account of the expenditure and the income from this crop, as in almost all cases the crop is grown for home consumption. The labour employed is that of the cultivator himself or that of the persons in his family.

However we can see from the above account that even when there is a limited water-supply, a cultivator with a family of five persons can maintain himself and his family on an area of ten gunthas or a quarter of an acre under the crop of sweet-potatoes for a period of six months and in addition gets fodder supply sufficient for at least six weeks for one pair of working cattle.

It is the belief of the cultivators of the place that the crop of sweet-potatoes specially flourishes during famine conditions and that is why it is pronounced to be the only crop which can save the cultivator from the effects of famine.

Megachile Bees and Crotalaria Juncea (Sann Hemp).

BY

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A field of *sann* hemp is the most gladdening sight on a farm when it is in flower. The thick mass of flowers attracts innumerable bees, small and large, which seem to visit these flowers by preference. Although it is a matter of common knowledge that bees fertilize flowers, the case of *sann* hemp is peculiarly interesting in that, only certain kinds of bees seem capable of fertilizing them, and others not. The flower though gaudily dressed is without any scent, neither could any store of honey be discovered in its depths. The only attraction to the bee is therefore the gaudy yellow colour.

A careful examination of the flower is necessary before we can understand the relation of the bees to the flower and the necessity of bees to effect cross fertilization. The bud is completely enclosed in the large calyx and when it bursts out of this confinement, the calyx is divided into two parts. The more slender portion occupies a position immediately behind the standard, the lower larger portion covers the keel from below. The lower portion is springy and is capable of regaining its normal position if it is pressed down mechanically and subsequently released. This is probably the most important part of the flower. The other parts of the flower are arranged as in most other leguminous flowers, except the keel which is a little different from what is commonly found in other flowers. It conceals inside it, as in other flowers, its more delicate parts, the ovary, stamens and the style. To understand the relations which these parts bear to the keel, the flowers require to be dissected at different times of their development. While in bud the ovary is slightly bent to occupy the sharp bend of the keel imitated by the lower part of the calyx. The style is straight but springs at an angle from the ovary and is furnished with stiffish hairs about the tip. Normally the stigma occupies a position level with the opening of the twisted tip of the keel. The keel is very much like the keel in other flowers except that it is twisted at the tip leaving a small hole for the protrusion of the style under mechanical irritation. The stamens are ten in number and of unequal lengths. In the bud, five are short with small heads of pollen and five longer with massive linear pollen heads. In older flowers the relative lengths of these two kinds of stamens change. The shorter ones of the bud continue to grow and outstrip the longer ones, and now are the longer of the two. Dissection at different stages of the growth of the flowers reveals the fact that this is a device intended specially for the purpose of carrying the ripe pollen grains from the linear massy anthers to the tube of the keel at the tip. It is possible that the pollen is shed by the linear anthers and is pushed to the tip by the growing stamens of the first type.

It is now possible to understand how the bee effects cross pollination. The bee in question alights upon the platform formed by the wings and presses the keel which rebounds to occupy its normal position soon after the pressure is released by the bee. It will now be seen that the tip of the keel has sticking to its end a small quantity of pollen.

If the mechanism of the flower has been understood properly it will not be difficult to conceive how this has been brought about. The keel on being pressed allows the stiff style to protrude through the round hole at the end carrying with it a quantity of pollen sticking to the stiff hairs When the pressure is released the keel goes back to its normal position. The pollen grains however are scraped off by the tip of the keel and left sticking to the end of it which the bee carries off by assiduously rubbing its hairy adbomen on the tip of the keel. By closely observing the bee it is evident that the legs play an important part in the transfer of pollen from the flower to the abdomen. The same flower is thus irritated a number of times before the bee transfers its attention to the next flower and every time it does so the store of pollen on the underside of the abdomen grows bigger. Most other bees collect pollen on their legs which are specially provided with collecting hairs and other paraphernalia necessary to this function. But the bees that visit *sann* flowers in preference, have these devices on the undersides of the abdomen instead of on their legs. These bees are known as Leaf cutting bees belonging to the genus *Megachile.* The two chiefly concerned are *Megachile anthracena* and *Megachile lanata.* The former is the larger of the two and is black in colour while the latter is a little smaller and yellowish, There are other bees among which a small blue bee *Ceratina viridissima* is particularly noticeable among these flowers. It is however incapable of exerting enough pressure for a proper response from the flower and is therefore incapable of being useful to the flower. Examination of pollen from the body of this bee under the microscope also shows very few grains of *sann* pollen upon its legs, while lumps of pollen from Compositæ form the largest bulk. This shows that this small bee collects pollen from the more open flowers of Compositæ and the few grains that are found probably have been collected accidentally while moving among *sann* flowers. Microscopic examination of pollen on the bodies of *Megachile* bees shows that the stores are almost entirely made up of *sann* pollen. A careful examination of the *Megachile* bees in the act of collecting pollen shows that it requires considerable effort on the part of the bee to rob the *sann* flower of its carefully guarded pollen. On alighting, the bee is seen to thrust its head forward and extend its mandibles to catch hold of two projections at the base of the standard which it opens wide by means of its head. The forelegs and the intermediates clutch hold of the wings while the abdomen is engaged in pressing the keel. The hindmost pair of legs assists the abdomen in collecting the pollen, more particularly from the sides of the keel. The smaller bees are incapable of doing this on account of their small size and consequent smaller weight of their bodies.

Larger bees than *Megachile* have often been seen visiting *sann* flowers but they have not been observed sufficiently in this light and observations carried on in this direction will be interesting in the extreme. So far it seems the *Megachile* bees are the only ones that are capable of affecting cross pollination of *sann* and the flowers do not produce fruit if the bees are prevented access to the flowers. Flowers bagged in the bud state in a paper cover failed to produce any fruit. The bees then are absolutely necessary for cross pollination and particular bees only can effect this. There may be many other Crotalarias wild in nature and if cross pollination is the only means of re-production there is likelihood of a number of crosses being found in nature. The subject is too interesting to allow of its being dropped at this stage, and I am continuing my inquiries into it further.

A Curious Case of the Juxtaposition of two trees

BY

H. P. Paranjpye, B. A.

It is a case of suicidal hospitality to invite guests in a famine-stricken family. This is equally true of growing two or more trees in one hole especially in districts with precarious rainfall. The inadvisability of this practice need not be mentioned to the reader of this magazine. But an interesting case of the association of two trees was observed some time back near Kurduwadi Railway station and is explained below as a scientific curiosity.

A *nim* tree (*Melia Azadirachta*) and *nandruk* tree (*Ficus retusa*) were planted in one hole, and situated as they are in a favourable condition, both are growing well. A branch of the *nandruk* is closely growing over a branch of the nim tree and almost at right angles to it. In course of time the two branches could not properly grow in thickness where they touched one another. The result was that the bark of the *nim* branch grew over the branch of the *nandruk* tree and almost completely encircled it. The effect of this strangulation of the *nandruk* branch is this. Since the water supply to the branch is partially cut off, it is not so healthy as the other branches of the tree ; similarly no sap is flowing from the leaves of the branches below the strangulated part. The proximate part of the branch, therefore, has remained slender. The distal end which stores all the food received from the leaves has grown thicker. Some adventitious roots are developed at the base of the distal end.

This being the present state of the *nandruk* branch it is very likely that when the adventitious roots reach the ground and absorb, from the soil, water and salts in adequate quantities, the branch will be a virtually independent colony of the original *nandruk* tree, the slim proximate end showing the real nature of the relation between the two trees. Many a *Ficus* tree has a tendency to produce adventitious roots which ultimately make their branches independent of the mother tree. But a case like the above is apparently rare and is therefore brought to the notice of the readers of this magazine.

An Ecological study of the Chattersinghee Forest Reserve.

BY

M. Ezekiel, M. Sc.,

(Continued from the previous number.)

A study of the factors influencing the vegetation of the area shows that it is typically xerophytic. Foresters put it down as Semi-Arid. The vegetation though poor in species, is rich in numbers and is characterised by extreme poverty of tree-flora. Among the commonest vegetation types are stem succulents, microphyllous and sclerophyllous shrubs, microphyllous deciduous shrubs, deciduous trees, perennial grasses and ephemeral herbaceous plants. The terrestrial hebaceous vegetation varies from extreme weather (comparatively) in individuals in the depressions, and at the base of the Vetal hill to almost complete absence in many places such as the S. W. top, western slope and the base of the Burns Point.

In the absence of its epiphytic vegetation, the forest reserve is typically arid in character. The representation of lianes of the hardy type is not poor in comparison with the poverty of the flora in species, several Asclepiads flowering in the dry months being characteristic. *Rivea Hypocrateriformis*, is by far the most striking of climbers, and is very abundant both on the Eastern and the Western slopes. Its juvenile shoots, six to eight feet long with small tomentose leaves, are seen waving about in the air in search of support, in the hottest months of the year. The other Asclepiads deserving mention are *Dregea volubilis*, *Leptadenia reticulata* and *Hemidesmus indicus*.

The following are the plants commonly found in the area studied.

TREES AND LARGE SHRUBS.

Capparidaceae	*Capparis grandis* Linn.
Bixaceae	*Cochlospermum Gossypium* D. C.
Tiliaceae	*Grewia asiatica* Linn.
Burseraceae	*Boswellia serrata* Roxb.
Meliaceae	*Melia Azadirachta* Linn.
Celastraceae	*Elæodendron glaucum.*
Do.	*Gymnosporea montana* Lawson.

Rhamnaceae	*Zizyphus jujuba* Lam.
Do.	*Do. oenoplia* Mill.
Do.	*Do. zylopyrus* willd.
Anacardiaceae	*Odina woodier* Roxb.
Do.	*Rhus mysorensis*
Leguminosae	*Acacio arabica* willd.
Do.	*Do. leucophloea* willd.
Do.	*Mimosa hamata* willd.
Combretaceae	*Anogeissus latifolia* Wall.
Lythraceae	*Woodfordia floribunda* Salisb.
Rubiaceae	*Randia dumetorum* Lamk.
Do.	*Morinda citrifolia* Linn.
Do.	*Do. tinctoria* Roxb.
Cleaceae	*Schrebera Sweitenoides* Roxb.
Apocynaceae	*Carissa Carandas* Linn.
Boraginaceae	*Ehretia aspera* Roxb.
Verbenaceae	*Lantana camara* Linn.
Bignoniaceae	*Dolichandrone falcata* Seem.
Do.	*Heterophragma Roxburghii* D. C.
Santalaceae	*Osyris arborea* Wall.
Euphorbiaceae	*Flueggea Leucopyrus* Willd.
Do.	*Jatropha curcas* Linn.

LIANES.

Vitaceae	*Vitis Woodrowii* Stapf.
Do.	*Do. Setosa* Wall.
Leguminosae	*Abrus precatorius* Linn.
Do.	*Phaseolus trilobus* Ait.
Do.	*Rhynchosia Minima* D. C.
Cucurbitaceae	*Corallocarpus epigaeus* C. B. Clarke.
Asclepiadaceae	*Ceropegia hirsuta* W. and A.
Do.	*Dregea volubilis* Benth.
Do.	*Hemidesmus indicus* Br.
Do.	*Leptadenia reticulata* W. and H.
Do.	*Sarcostemma brevistigma* Wight.
Convolvulaceae	*Rivea hypocrateriformis*, Chois.

SHRUBS, ANNUALS AND EPHEMERAL HERBS.

Papaveraceae	*Argemone mexicana* Linn.
Capparidaceae	*Cleome simplicifolia* H. F. and T.
Polygalaceae	*Polygala Chinensis* Linn.
Do.	*Do. erioptera* D. C.

Malvaceae	*Sida Spinosa* Linn.
Caryophyllaceae	*Polycarpaea corymbosa* Lamk.
Zygophyllaceae	*Tribulus terrestris* Linn.
Geraniaceae	*Biophytum sensitivum* D. C.
Sapindaceae	*Cardiospermum halicacabum.*
Leguminosae	*Alysicarpus rugosus* D. C.
Do.	*Do. tetragonolobus* Edgw.
Do.	*Cassia tora* Linn.
Leguminosae	*Heylandia latebrosa* D. C.
Do.	*Indigofera linifolia* Retz.
Do.	*Do. cordifolia* Heyne.
Do.	*Zornia diphylla* Pers.
Rubiaceae	*Anotis montholoni* Hook.
Do.	*Oldenlandia corymbosa* Linn.
Do.	*Spermacoce hispida* Linn.
Do.	*Do. stricta* Linn.
Compositae	*Ageratum conyzoides* Linn.
Do.	*Echinops echinatus* D. C.
Do.	*Glossocardia linearifolia* cass.
Do.	*Launea nudicaulis* Less.
Do.	*Pulicaria wightiana* D.
Do.	*Sonchus arvensis* Linn.
Do.	*Tricholepis radicans* D. C.
Do.	*Tridax procumbens* Linn.
Do.	*Vernonia cinera* Less.
Do.	*Vicoa auriculata Cass.*
Asclepiadaceae	*Caralluma fimbriata* Wall.
Boraginaceae	*Heliotropium tuberculosum* Bois.
Do.	*Trichodesma indicum* Br.
Convolvulaceae	*Evolvulus alsinoides* Linn.
Scrophulariaceae	*Celsia coromandeliana* Vahl.
Do.	*Linaria ramosissima* Wall.
Do.	*Sopubia delphinifolia* G. Don.
Do.	*Striga densiflora* Benth.
Do.	*Do. lutea* Lour.
Do.	*Do. orobanchoides* Benth.
Acanthaceae	*Justicia diffusa* Willd.
Labiatae	*Lavandula Burmanni* Benth.
Do.	*Leucas longifolia* Benth.
Do.	*Orthosiphon pallidus* Royle.
Nyctaginaceae	*Boerhaavia repens* Linn.
Amarantaceae	*Aerua lanata.*

Euphorbiaceae	*Euphorbia hypericifolia* Linn.
Do.	*Do. pilulifera* Linn.
Do.	*Do. thymifolia* Burn.
Do.	*Phyllanthus maderaspatensis* Linn.
Ammaryllidaceae	*Curculigo orchioides* Gaertn.
Liliaceae	*Asparagus racemosus* Willd.
Do.	*Chlorophytum tuberosum* Baker.
Do.	*Dipcadi montanum* Dalz.
Do.	*Iphigenia indica* A. Gray.
Do.	*Scilla indica* Baker.
Commelynaceae	*Cyanotis fascicularis.*
Do.	*Do. tnberosa.*
Gramineae	*Andropogon annulatus Forsk.*
Do.	*Do. contortus* Linn.
Do.	*Do. foveolatus* Del.
Do.	*Do. monticola* Schult.
Do.	*Do. triteceus.*
Do.	*Chloris.barbata.*
Do.	*Digitaria pedicellaris* Prain.
Do.	*Do. sanguinalis* Scop.
Do.	*Eleusine indica* Gaertn.
Do.	*Eragrostis bifaria.*
Do.	*Do. minor.*
Do.	*Do. pilosa* Beauv.
Do.	*Do. tenella* Roen and Schults
Do.	*Gracilca Roylsana* Hook.
Do.	*Ischaemm pilosum* Hack.
Do.	*Iseilema anthephoroides.*
Do.	{ *Lepturus Roxburghiana* Studhill. { *Tripogon Do.* Bhide.
Do.	*Lophopogon:tridentatus.*
Do.	*Ophuirus corymbosus* Gaertn.
Do.	*Panicum trypheron* Schult.
Do.	{ *Paspalum pedicellaris* Trin. { *Digitaria Do.* Prain.
Graminaceae	*Setaria glauca* Beauv.
Do.	*Sporobolus diander* Beauv.
Do.	*Do. indicus.*
Do.	*Tragus racemosus* Scop.
Cyperaceae	*Cyperus Teneriffe* Poir.
Do.	*Fimbristylis monostachya* Hook.
Do.	*Kyllinga triceps* Rottb.

Excepting the small number of ephemeral herbaceous plants that germinate at the commencement of the rains, and complete their reproductive processes by the end of the wet season, the large majority of plants in the area are typically xerophytic in characters. There are some herbaceous plants that show two forms :—The Sun form and the Shade form, the former forms alone are able to stand the desiccating influence of the dry winds and heat, and live with peculiar resistivity till the commencement of the rains of the following year. The results of estimation of water-content of the root-zones of several herbaceous plants show that they are able to withstand great poverty in water-content. In most cases the samples of soil showed little more than four percent of water for dry soil. They are characterised by a deep seated root-system—consisting mainly of a powerful hard and woody tap-root, reaching a depth of nine to fifteen inches. Among xerophytes the following deserve special mention :—

Compositae	*Tridax procumbens.*
Do.	*Vernonia cinera.*
Do.	*Launea nudicaulis.*
Do.	*Echinops echinatus.*
Nyctaginaceae	*Boerkaavia repens.*
Zygophyllaceae	*Tribulus terrestris.*
Convolvulaceae	*Evolvulus alsinoides.*
Euphorbiaceae	*Euphorbia pilulifera.*
Do.	*Do. thymifolia.*
Leguminosae	*Indigofera linifolia.*
Polygalaceae	*Polygala erioptera.*
Do.	*Do. chinensis.*

ROOT PARASITES.

Scrophulariaceae.	*Striga lutea.*
Do.	*Do. densflora.*
Do.	*Do. orobanchoides.*

CALCICOLOUS PLANTS.

Euphorbia pilulifera.
Do. thymifolia.
Phyllanthus madraspatensis.
Vernonia cinera.
Launea nudicaulis.
Echinops echinatus.
Indigofera linifolia.

Polygala chinensis.
Do. erioptera.
Argemone mexicana.
Linaria ramosissima.
Tribulus terristris.
Evolvulus alsinoides.
Justicia diffusa.

The following plants assume the espalier shape.

Indigofera cordifolia.
Do. linifolia.
Heylandia latebrosa.
Phyllanthus madraspatensis.

PETROPHYTES.

Rhus mysorensis.
Woodfordia floribunda.
Acacia leucophlea.
Linaria ramosissima.
Mimosa hamata.
Sareostemma brevistigma.

The following associations of plants are found on the area chiefly along the east base.

I. Gymnosporea montana.
Flueggia leucopyrus.
Osyris arborea.
II. Gymnosporea montana.
Odina woodier.
Osyris arborea.
Zizyphus jujuba.
III. Gymnosporea montana.
Acacia leucophlea.
Mimosa hamata.

A biotic factor, which seriously affects the growth of some trees and shrubs, and many herbaceous plants is the presence of goats. The continual grazing of these animals in the forest reserve, results in a complete destruction of the vegetative shoots, of many plants, leaving the thorny and less useful plants untouched. Among trees, *Osyris arborea* is a case in point This plant is very sensitive to grazing and firing. Only such individuals as grow in the midst of and among the armed branches of Gymnosporea, Flueggia and Acacia and can thus escape the ravages of these animals survive. The underground portions of *Osyris* however, are not completely destroyed by grazing or firing, though many are seriously injured. The underground dormant portions give out fresh shoots soon after the first rains, and these grow at a tremendous speed, some shoots which were labelled and watched from day to day, showed a growth of twenty-five inches in twenty seven days.

CHYLOPHYLOUS PLANTS.

Scilla indica.
Chlorophytum tuberosum.
Cyanotis fascicularis.
Cyanotis tuberosa.
Indigofera linifolia.

CHYLOCOULA.

Carulluma fimbriata.

SCIOPHYLOUS PLANTS.

Scilla indica.
Asparagus recemosus.
Ceropegia hirsuta.
Curculigo orchioides.
Corallocarpus epigeous.
Vitid woodrowii.

ECOLOGICAL NOTES ON PLANTS.

Euphorbia thymifolia Burm :—The nyctitropic movements of certain leaves, particularly of leguminous plants are well known. The normal day position of the leaflets is in a plane at right angles to the light. At night in certain species the position consists of a folding upwards and forwards, while in other species the leaflets droop or hang straight down. The leaves of this plant, however, take up certain peculiar positions during the day and night. These may be termed xerophotic—because they seem to be due to differential turgidity in the pulvini of the leaves, caused by a greater drying effect on the upper side, under one-sided illumination. Within an hour or so after sunrise, the leaves are seen to be open—placing their surfaces at right angles to the rays of the sun. This position remains until the sun is nearly overhead. Then the leaves begin to fold upwards until they form an angle of 45 degrees to 70 degrees with the horizontal. Two hours before sunset, the leaves begin to move forward, pointing the tips towards the apex of the trailing branch, and within two hours after sunset they are completely over-lapping. During the night the same position continues until at break of day the leaflets begin to bend back. The tip of the leaflet is the first to show response. Gradually the whole leaflet bends outwards and backwards until it reaches the horizontal or day position. This position is maintained until just before noon, when the vertical position begins to be assumed, and is actually assumed two hours after mid-day. There are two forms, the Sun-form and the Shade-form. The plants growing in more favourable situations as regards water supply, and such as are under the shade of trees, where desiccation is comparatively small, show large leaves which are deep green and there is little or no deposition of anthocyanin pigment. The stem also shows a very faint deposition of anthocyanin. The Sun-form on the contrary shows two varieties :—

I. The ordinary variety.

II. The calcicolous variety.

The ordinary variety has a deposit of anthocyanin—the colour deepening in the more dry situations. Where the soil is sandy and the evaporation great there is a grêater deposition of anthocyanin. If the soil is clayey and retains moisture in spite of a small supply, the colour is less deep. The calcicolous variety is intensely red, almost scarlet all over. The explanation seems to be this. —Lime has a tendency to flocculate the soil particles, the capillarity of the calcareous soil is thus greater than a non-calcareous one. There is thus in a calcareous soil, greater loss of water even from the deeper layers, and the plants growing there are liable to suffer from drought more than those in a soil without lime. The plants by procuring a deeper deposit of anthocyanin protect their tissues from destruction by the hot rays of the sun. This habit of deposition of anthocyanin in the stem and leaves, is common in many herbaceous and shrubby xerophytes growing on the hill and elsewhere. Nanism or stunted growth is a common phenomenon exibited by these plants.

Emphorbia pilulifera Linn :—This plant shows movements of leaves very similar to those of *Euphorha Thymifolia.* But the folding of the leaves is less close. The deposit of anthocyanin in the leaves is often in dots, these sometimes assuming the fantastic shapes of ink-blots, on the upper surface of the leaves.

Euphorbia geniculata Orteg :—A careful examination of a very large number of plants shows that the following changes are observed in individuals growing in less favourable situations as regards water supply. The leaves become smaller and smaller, the size of the plant also following suit. Plants in the more calcareous soil showing a greater deposition of anthocyanin pigment, accompanied by a reduction in the number and size of the leaves. This was more clearly observed on the Agricultural College farm where the percentage of lime in the soil increases from 2·5 p. c. on the East side to 12 p. c. on the western side of the farm.

Iphigenia indica A. Gray:—The flowers show trimorphic heterostyly.—

I. Stemens sessile.

II. Filaments very long, reaching the height of the stigma.

III. Filaments not reaching the length of the stigma.

The plant grows plentifully in grassy places and when in fruit can scarcely be distinguished from grass. It flowers in July and August.

Scilla indica Baker:—Grows plentifully under the shade of trees and shrubs, more especially where there is a plentiful supply of humus and nitrogenous manure derived from the excreta of cattle and goats. The leaves are thick and fleshy with black dots on the upper surface. The propagation is chiefly by means of a tunicated bulb which remains underground. Within a few days after the first few effective showers of rain, one or more thick fleshy leaves appear aboveground, and within a fortnight most of the plants are in flower. The chief adaptive feature is extreme brevity of existence. It flowers from June to July.

Curculigo orchioides Gaertn:—Leaves plaited. Flowers yellow arising at the sides and hidden from view by the leaves. Possesses a very deep thick tap root reaching a depth of three feet six inches and a thickness of more than an inch, at the crown. The root gives off numerous laterals of the first order which are thick and possess but few root hairs. It flowers from July to September.

Asparagus racemosus Willd:—Root tubercled. The juvenile shoots appear aboveground soon after the first few showers of rain. This flowers in June and July.

Rhynchosia minima D. C.:—Examination of the root system of a dozen specimens gave the following result. The root system consists of a straight deep tap root, reaching a diameter up to one centimeter. The deep feeding habit seems to be hereditary as is evident from the possession of deep roots even by plants growing in situations with an ample supply of water. It flowers at any time from April to December.

Dipcadi montanum : Dalz :—Only three specimens of this plant were found on the East slope of the hill. These were collected on the 4th, 6th, and 7th of May. A most searching examination of the whole area failed to give a trace of the same species elsewhere. An estimate of the water-content of the soil of the root-zone gave a percentage of 3·2. That this plant thrives in the midst of such desiccating conditions, and with such a small water-content, is explained by the numerous adaptations of the plant. The bulb serves as a reservoir, not only of nutriment but also of water. There are no leaves on the plant at the time of flowering and evaporation of water from the peduncle is prevented by the formation of a thick shining cuticle all over. The perianth is fleshy, the flowers reddish, and open at 7–30 in the morning. The shining cuticle reflects a good deal of the light and thus saves the plant from injury by excessive heating.

Indigofera linifolia Retz :—A calciphilous plant, generally creeping, silver grey with addressed hairs. Leaves thick, narrow. Plants growing in the calcareous regions show a thicker covering of hairs and narrower leaves than those growing in other parts of the hill. It flowers from June to December.

Lantana camara Linn :—A very powerful petrophyte, even the juvenile shoots being hard and woody. Grows plentifully in rock crevices. It flowers all the year round.

Indigofera cordifolia Heyne :—A deep feeder. The shoot assumes an espalier shape, the several branches radiating out in all directions from the main stalk. Leaves thick, hairy with black glandular dots. Found plentifully in sandy situations. This flowers from July to December.

Glossocardia linearifolia Cass :—The seeds germinate quickly after the first showers, and the plant flowers even in the dryest years. Fond of rocky places where brevity of existence is-its chief adaptation. It flowers from July to November.

Vicoa auriculata Cass :—Conspicuous in the midst of loose grass by its erect rigid shoots, often plentifully branched, reaching a height of three or four feet. It flowers from July to December.

Launea nudicaulis Less :—A very troublesome weed on the farm. A deep feeder. Can stand much lime. In dry parts of the hill and in calcareous regions it shows an extreme form of nanism—a plant two inches in height sometimes found flowering. The flowers appear from July to April.

Echinophs echinatus D & C:—Member of a desert flora. A calcicolous plant. Very plentiful in the neglected fields not far from the hill. A very deep feeder, flowering from August to May.

Cassia tora Linn:—A cosmopolitan plant and a very deep feeder. Grows even on ant-hills which are otherwise perfectly bare. This is the first plant to germinate after the first rains, and the seedlings possess an extraordinary power of resisting drought. This was noticed when the long break of rains in July 1917 killed the seedlings of almost all plants. Most of the grasses had become brown but the seedlings of cassia tora were still thriving without any sign of injury from drought, except that they had not grown in size. Grows with remarkable tenacity even in places where xerophytic grasses are conspicuous by their absence. Flowering occurs from July to December.

Phaseolus trilobus Ait:—A diffuse twiner. The main shoot is short barely an inch in height, but gives off several branches which radiate in all directions.

Phyllanthus madraspatensis Linn:—A very troublesome weed on the Farm, especially in the calcareous portions. Possesses a straight deep tap root. In one typical case the shoot measured barely 1·5 inches in height, while the root reached a depth of 28 inches.

Trichodesma indicum Br.:—A hispid herb. The long villous hairs prevent rapid transpiration on the one hand and accumulate drops of dew which are held with considerable surface tension. Very common in grassy places.

Tribulus terrestris Linn:—A member of the desert flora. Shows two forms, the sun form and the shade form. The shade form germinates in June and flowers from July to December. The leaf pinnae are broad, thin and fully extended. The sun form germinates at the end of the rains and continues its existence right to the end of May. This form is found growing along cart-roads and flowers in March and April. The petals are narrow. The leaves are narrow, curled backwards and richly tomentose.

Linaria ramosissima Wall:—A very powerful petrophyte. It sends its root deep in the rock cravices and flowers from July to December. After that the aerial portions of the plant die out. The hard woody subterranean portions which seem to serve as a depository of water and nutriment, remain dormant till the beginning of the following wet season. After the first few showers, these resume their activity, give off straight shoots with broad leaves at the base, terminating in an inflorescence. Very common on the Fergusson hill.

Woodfordia floribunda Salisb :—A powerful petrophyte. The deposit of anthocyanin on the leaves is probably an adaptation against excessive transpiration, and injury due to heating by the rays of the sun. It flowers from January to March. (Vide photo No. 14).

Argemone Maxicana Linn :—A very powerful xerophyte and a deep feeder. A small plant six inches in height had roots reaching a depth of 35 inches. A very troublesome weed in *jowar* and rice fields in the Bombay Presidency.

Striga lutea Lour and Striga densiflora Benth.—Both are root-parasites on wild grasses. Both are pests on sugar-cane, *jowar* and maize. This parasitic plant occurs quite frequently in open grass-land, and adapt themselves very easily to grow on the roots of *jowar* plants. Their seeds remain in the soil without germinating until in the presence of a suitable host, they germinate, attach themselves to the root of the host, and draw all their nourishment from it. In presence of such roots, the *Striga* seeds will germinate even a foot under the soil. The parasite thus grows and comes to the surface some weeks later to mature its own flower and seeds.

Within three days of its appearance above the ground it flowers, and fruits within a week. As each flower may produce two hundred seeds, the spreading is very rapid unless uprooting is very quick and complete.

Striga orobanchoides Benth.—A parasite on the roots of *Lepidaghaths cristata.* There is perfect atrophy of the roots, attachment being at a single point, whilst the adult plants are devoid of chlorophyll and assume a purplish red colour. Parasitic also on *Hygrophila Serpyllum Lepidaghatis trinervis* and on *bajri* and *jowari* Known in South Africa to be parasitic on the roots of rushes, and many other plants.

Sopubia delphinifolia G. Don :—A parasite on grasses. Very common in grassy places.

Caralluma fimbriata Wall.—A chylocoulous aphyllous petrophyte. A plant was carelessly uprooted from its habitat, and exposed to the hot sun to dry. After a week's ordeal of this kind, the plant showed only a slight, almost inappreciable drying of the apical portion. It was then kept in a room and was found to be flowering in the midddle of June, though not a drop of water had been supplied to it.

Two small pieces were cut off from another plant, one from the top and one from the base of the stem, and weighed accurately. These were then placed in an oven at 100 degrees for 36 hours and weighed again. The top piece was found to contain 73·85 p. c. of water and the basal portion 92·83 p. c. The following conclusion therefore becomes irresistible During the wet months there is a rapid absorption of water and nutriment which is stored in the basal portions of the stem. During the hot weather this store is so economically used up that at the end of the dry season there is still sufficient of it left for the production of flowers in June.

Ceropegia hirsuta W. & A. :—At the commencement of the wet season the corm gives out shoots and the plant begins to flower when it is barely six inches long, and continues to flower till the end of October, the shoots reaching a length of not more than one foot. The plant twines round the leaves of grasses amongst which it hides itself. The flowers are inconspicuous and are visited by very minute insects. Two specimens were brought intact from the hill and planted in pots, one alone and the other with some grass plants round about. The former died within a few days, while the latter thrived and continued to flower right to the end of October more vigorously when the grass was plentiful.

Sarcostemma brevistigma :—An aphyllous petrophyte. Grows only in rock crevices in the most exposed situations.

Rivea hypocratertformis Chois :—A deep rooted powerful twiner. The flowers are large, white, fragrant and open at sunset. They are visited by nocturnal insects that take shelter in them against the cold of the night. The plant is leafless from February to the end of March but in April it gives off fresh shoots. The juvenile shoots reach a length upto eight feet, and are seen waving about in the air, in the hottest months of the year. The thick tomentum on the leaves is a suitable adaptation to the dry situations in which it thrives.

Evolvulus alsinoides Linn :—A cosmopolitan plant grows vigorously in soil with a water-content of not more than four per cent in the hottest months of the year, and in soil containing up to twelve per cent of lime. In addition to the two Euphorbias evolvulus is the only plant thriving in the calcareous areas. The rich tomentum on the leaves of plants growing in the calcareous areas is remarkable. This plant flowers from July to May.

Boerhaavia repens Linn :—An extremely variable plant. Grows in all kinds of soils, sandy, calcareous, loamy, or rocky. Shows extreme type of nanism both in the dry and in the calcareous soils. In both cases the stem and leaves are protected by a deposit of anthocyanin. The smallest flowering specimen seen, was two inches long, the largest, found in a well manured field of fodder crops was eight feet in length.

Portulaca oleracea Linn :—The plant has two forms. The sun form, short and stout, the whole plant red due to the deposit of anthocyanin. This form thrives even in soil containing three per cent of water. Plants growing in dry exposed situations possess a deep thick root reaching a thickness of one third of an inch at the crown, where there is a special thickening. The shade form has no red colour. This plant flowers from July to February.

Cocculus villosus D. C.—Member of a desert flora. On the hill it grows plentifully in rock crevices, flowering from September to December.

Dodonea viscosa.—A common hedging plant. Shows two forms. The sun form has narrow short leaves. The shade form has broad and long leaves. In both cases they are erect.

Malvastrum tricuspidatum.—This plant, a description of which will be found in Hooker's Flora of British India, is new to the Bombay Presidency, and is not noted in Cooke's Bombay Flora. It was just seen in the compound of a bungalow in Poona, and was first mistaken for one of the Sidas. This caused much confusion in its identification. Mr. Bhide, the Government systematist at Ganeshkhind worked at it for days, but the plant could not be identified. On looking over the generic characters of Sida the description ("Involucral bracts O".) struck the writer and the plant was therefore at once excluded from that genus. Afterwards Mr. Bhide identified it as *Malvastrum tricuspidatum* A. Gray. It stands tremendous grazing by goats as was noticed from February to September 1917. The goats seem to like it immensely and the writer says the same plants eaten up by them sometimes to the very base of the stem and yet the plants continued to give out fresh shoots from day to day. The plants possess a straight deep tap root which bifurcates or sometimes divides into three branches, six inches below the crown. The flowers do not open before three o'clock in the afternoon, usually after 3.30 P.M. and remain open for little more than ninety minutes. It flowers from February to December.

Alternanthera repens A. Kunth.—A prostrate herb rooting at the notes, leaves opposite, flowers small, white, spinous, in rigid heads. Shows two forms a sun form with small leaves, growing only in exposed situations and a shade form growing in shade or in soil favourably situated as regards water supply. It has broader and thicker leaves. This also is a plant new to the Bombay Presidency. Mounted specimens of this were sent to the Royal Botanic Gardens. Sibpur, for identification. It is evidently an introduction from South America.

Entomological and Botanical Tour.

BY

A. Subrahmanyam. (Senior B. Ag.)

(*December 1918.*)

OUR party consisting of the two optional Botany students, the two optional Entomology students and Professors Ajrekar, Rama Rao and Paranjpye left Poona by the 10 P. M. passenger on the 8th, December, and proceeded straight to Bassein. On the 9th Morning, we were met by Mr. Joshi, the Superintendent of the Ganeshkhind Botanical gardens, who had, previous to coming to Poona, worked in the Bassein gardens. He took us to the fort; on the way, we visited several private gardens including Mr. Joshi's own garden. In his garden, we saw a chikoo plant reared by layering and a second one reared by grafting. The grafted one had grown tall and was vigorous while the layered one was very bushy. This difference in the habit of growth has convinced Mr. Joshi that a graft is decidedly better than a layered plant. After seeing Mr. Joshi's garden, we went to the fort and studied Mr. Joshi's work in the Government gardens. His work was mainly on grafting; his experiments tend to show that grafting in situ is much better than preparing graft on potted plants. He has also conducted experiments to determine the best height of stocks for grafting in situ. Next, we went to Messrs. Marathe and Co.'s nursery where we saw that only selected and *hardened* plants were kept for sale. By *hardened* plants we mean plants subjected, during their growth, to different conditions of temperature, light and such other climatic factors.

Next morning, we were joined by the rest of the class, except the Dairy people, under Professor G. K. Ranade. With them we spent the day in visiting several gardens and studying Bananas, Coconut, Betelvine and other Garden Crops. The same night, we left Bassein at 11 o'clock.

About 8 O'clock in the morning, we got down at Utran whence we proceeded to Varacha. This is one of the places in Surat District noted for the typical Gujrath vegetable gardening. After studying other garden cultivations we went to Surat. Here, we joined Professor Knight's party. At 5 P. M. we all met Professor Knight on the Farms. He took us round the Farm giving us much valuable information. The standing Crop of cotton on the Farm showed us, as Prof: Knight specially pointed out, how opportune sowing ensures a good Crop.

On the 12th morning, Professor Rama Rao took us to the Entomological museum while the Botany students were taken to some fruit gardens; the other party had left Surat for Broach by the early morning train. We left the place at about 10 A. M. and proceeded straight to Baroda; on the way, we were joined by the others at Broach. In the evening, we went round the Farm with Professor Knight and Mr. Amritlal Desai, Director of Agriculture.

Next morning our party went to Ranoli to see *Bor* cultivation. The owner of an extensive plantation of *Bor*, one Mr. Nathabhai Kalidas Patel, took us round the garden and gave us very valuable practical advice. He was a keen observer of things and had a more or less scientific turn of mind. Under his able management, the garden is yielding him good return. But the unfortunate circumstance is that the *Bor* is subject to the attack of a fly pest which lays eggs in the fruits just as they begin to ripen and the maggots developing in the fruits cause considerable damage. We collected many of the attacked fruits in order to rear the pest out and see if any parasite would hatch which could be introduced to check the pest. At about 1 P. M. we returned to Baroda. On the 14th our parties separated, and the 14th and 15th we spent in the study of Ornamental Gardening; during those days, we found time to visit several places of interest such as the Royal places at Makarpura and Nasirbagh, the Kalabhuvan, the museum and the Zoo, and the public library. By the night train on the 16th, we went to Amalsad.

At Amalsad we saw pine-apples and 'Piper longum' cultivated extensively; we had also been to the farm. After a day's stay at Amalsad, we proceeded to Golwed where we were met by Mr. Masani, a graduate of our college, who took us round the places and showed us the best chikoo and pomello cultivations. After a day's stay there, we went to Bombay.

At Bombay, we were joined by the others. Two days we spent there; the first day we went to the Byculla Market, Veterinary hospital, Parel laboratory and Victoria gardens. the next day, our party went to Thana to study *floriculture.*

Professor Ajrekar had left the party at Baroda and Professor Rama Rao now left the party; but we had two additions now, Professor G. S. Kulkarni and Mr. G. M. Bapat. We proceeded by the 21st morning's boat to Revdanda. After studying Coconut, Arecanut and Betelvine cultivations, we went to Alibag. Next day, we stayed at Alibag and visited a few private gardens and the Varsoli farm. On the 23rd we left Alibag at about 12 noon and reached Bombay at 4 P. M.; thence the party proceeded to Poona by the 10 P. M. train.

At all the places we visited, we had a cordial and hearty reception. All the people we came into contact with, particularly the cultivators and owners of gardens, gave us all the information we needed without any hesitation. This open-mindedness of these people made the tour the success it has been.

Mr. Joshi's Work at Bassein.

BY

A. Subrahmanyam (Senior B. Ag.).

MR. Joshi's work at Bassein was restricted mainly to experiments in *grafting* and the conclusions he has drawn from them are interesting from a commercial point of view.

Grafting.—Mr. Joshi holds that a plant with a clean and tall stem is a better yielder than a bushy one. His idea is that a tall plant possesses a wider base *i. e.*, a root-system spreading wide and deep; such a plant gets more light and more air and the growth of foliage and fruiting branches is extensive; as the foliage and fruiting branches spread out, there is a corresponding extension in the root-area; and consequently, such a plant will thrive much better than a bushy one with a limited root-area. Working upon this idea, Mr. Joshi selected mango seedlings which had clean and straight stems and grafted them *in situ* with the desired variety. The grafts throve very well, a clean and straight stem was secured and they grew just as naturally as seedlings. He also made experiments to determine the best height at which the stock should be grafted on, in order to secure a clean and sufficiently tall stem. He took stocks of the same age and grafted them in situ with scions of one age; the grafting was done at different heights on different stocks. The best height at which grafting could be done with advantage was the height at which the stock began to bifurcate.

Top-working.– To reclaim wild and old trees, Mr. Joshi does not adapt crown-grafting or side-graftings; he adapts *top-working.* In *top-working*, the principle is the same as that in crown or side-grafting; advantage is taken of the growth which the tree has made. The tree is cut at a convenient height and new shoots are allowed to sprout; of these new shoots, a few good ones are selected and each grafted with the desired variety. This is called *top-working*: Several trees have been thus treated in the gardens and they are all growing very well. On one wild mango tree, Mr. Joshi has, by this method, grafted four different varieties which bear at different times, some early and some late, so that he gets the tree yielding for a long time. This tree was grafted in the year 1913 and on the fourth year, it yielded more than 370 fruits; such an yield has not been realised in crown or side-grafted trees in such a short time, *Hardening of plants*- The practice of getting plants of good stamina by selection and hardening, we came accross, for the first time, in the nursery of Messrs. Marathe and Co. This method has been advocated strongly by Mr. Joshi. The necessity for selection is obvious. If we grow 100 seedlings, we do not get all of them growing healthy and strong. To attain the growth which a healthy plant makes in 1 year, the weak one will take a much longer time. Thus, for grafting, the strongest will be ready first and the weakest the last; so, a nurseryman will have to spend more on the weak plant, only to get a weak graft in the end. Such being the case, rejection of weak plants ensures economy.

Mr. Joshi says that hardening of plants is necessary for the benefit of the buyers since there is a great variation in the condition of the different localities to which the grafts are sent; a well-hardened plant will thrive well in any locality but were one not hardened to be in its place, it will die out. So, in order to suit the requirements of the various growers, it is the first duty of the nurseryman to supply them with well-hardened plants.

Selection and hardening are the main features of this nursery. We were told that this is a new concern and only a limited number of mango and chikoo grafts are ready every year for sale to the public; but these few ones are selected and hardened ones. Such plants will be reserved for customers if previous notice is given to the firm.

Process of hardening as practised in Marathe and Co.'s nursery is as follows:--Seeds are sown in pots and the pots are kept crowded together and a straw mulch is spread over them. When they germinate and the first leaves are formed, the mulch is removed and the pots are kept a little spread out. When the plants begin to bifurcate, they are kept well spread out and thus given more room. When about 9 months or 1 year old, they are grafted on with the desired variety and the pots ar shifted to a shady situation and kept there for a fortnight, then reared in semi-shade for 20 days; next, kept crowded in the open for about 20 days and finally, the pots are well spread out and ample room given for each plant. Thus, the plants get hardened by being reared under different conditions.

Sending plants by post- Mr. Joshi has recently found out a method of sending plants to customers by post. Sending per Railway parcel has been a difficult and costly method of despatch. The postal despatch will prove to be economical. When the plants are to be sent, Mr. Joshi makes them shed their leaves artificially, by gradually cutting off the water: When all the leaves are shed, he removes the plants carefully from the pots, washes them free of mud and dirt, packs them in a tin or box and despatches them by post. Mr. Joshi had sent 18 chikoo grafts by post from Bassein to Dapoli at a cost of Rs. 2/- (including packing charges). Similarly, 3 plants were sent to the Empress gardens from Bassein and these were unpacked after 6 days and were found to be quite intact.

The receiver has to revive the plants. This is done as follows:— The plants are taken out, put in pots containing leaf mould and fine earth and watered gradually. The pots are kept in a trench (about 4 ft. deep) under shade and thick screens (made of cotton stalks or other material) are placed over the trench in order to exclude light and to maintain an even temperature inside. As the buds develop, these screens are replaced by thinner ones in order to give some light to the growing buds. When the plants put forth one or two leaves, they are given more light by removing the screens for an hour or two during the day; gradually, they are given more and more light. Then, they are taken out of the trench and kept under shade, crowded together for some days and then spread out for some more days; next, they are brought to the open. By this time, the plants are established and will grow normally. If this method of reviving be taught to the customers, the nurseryman can adapt the method of postal despatch, benefiting both himself and his customer by so doing.

*N. B.—The soil should not contain any fermenting material such as farmyard manure for, if it does, the roots will decay.

The Moral of B. Ag. Botany Tour.

BY

C. Raghunathan.

THIS year's tour has been an exception to other years' owing to the many batches into which the class was divided according to the optional subjects.

Importance of Agriculture.

It is always true that certain unaccustomed events change the future of any individual and same is the case with nations or groups of men. What I mean by this is, that, the war has brought many changes in all walks of life of an individual as well as of nations. This can be amply supplemented by the amount of movements or forces that are at work in the world of which we hear daily.

The sudden change or variability (if I could call so) which created these forces in the minds of those guiding bodies of Nations have also directed them towards the once so-called layman's work-"Agriculture."

Agriculture was not understood or taken as a real science till the brutal force of the Germans came into operation. When this force came into operation great statesmen, and bright intelects started to find out a way to obstruct this force. After advancing various theories (not worth mentioning here) the world as a whole came to appeal to the once thought layman's work "Agriculture" to save them from the calamities.

Now, to-day the Allies have won the war and the improvement of agriculture stands as one of the foremost duties of the State in the world.

Advantages of this tour.

This so-called exceptional year has been of more value to the students at large in respect of the amount of facilities they were given by the respective professors who accompanied them in the tour, so that the students had a close opportunity of discussing the various points that appealed to them from the practical side of scientific agriculture.

I am sure, other friends of mine will bare me out in this case, especially those who were in the C and D groups.

A student in agricultural science looks at his profession with pessimism from the start towards the close of his carreer, simply because the surroundings are such that do not always go with his newly imbibed ideas.

This attitude on the part of the student ought to change at least in a few cases after the 3rd year's tour. This change of attitude must be still more so after seeing cultivations such as Mr. Joshi's garden (commercial one) and other Banana cultivations at Bassien, the *bor* (*zyziphy-zuzubee*) cultivation at Ranoli, Gujarat, the pomelo and *chichu* at Gholwad and so on.

Because these cultivations speak themselves of the high profit, agriculture will afford to an individual who will take care of the plants as he would of his own children.

To start with the tour, Mr. Joshi's garden, at Bassien, has not only been of great value from the horticultural point of view, but also raised very many problems which still await solution from further study and experiments in future. They are in brief as follows:— hardening of seedlings, paching of seedlings, natural pruning of *chichu* branches in grafted plants when compared with the *gooted* ones etc.

These created an interesting discussion among us and before we came to any conclusions we came across another intelligent cultivator at Ranoli who surprised us with amount of accumulated knowledge by experience ; he might in a way be called a "Burbank of Ranoli." This man gave us very good hints on practical difficulties with which he had to confront ever since his start of the business.

At present he possesses a few acres of bore (Zyziphy Zuzuba) cultivation which seem to thrive well.

I take this opportunity of pointing out that this fruit crop will do well for the Deccan conditions especially because of the simplicity of cultivation and from the point of irrigation.

This plant is xerophytic by nature and requires practically no water and other care except to keep the land clear of weeds to avoid the insect pests, on this fruit, breeding there.

I do not in this paper pretend to deal with the various cultivations that are carried on in various places, nor the time table of the tour, but I take liberty of requesting my successors to learn the moral lesson that this B. Ag. tour teaches us from the point of a cultivator in the Deccan and Gujurat.

Why is it that Bassien, Gholwad, and Ranoli appealed more to this group than any other places they have visited, undoubtedly the ingenious methods of cultivation that are being carried out by these practical men than those so-called model farms and model gardens maintained by government. I assert that no model farm or garden would have convinced any body of the importance of agriculture than the above named gardens.

If only there are a few hundreds of cultivators throughout this presidency as one at Rānoli, agriculture will not only be one of the best business but will also drive off famine that we experience now.

The three places mentioned above require separate notes on the respective cultivations which I hope our readers will be able to read in these colums of this issue.

Lessons.

I personally had a very pessimistic view of agriculture from the point of a commercial cultivator in this part of India owing to the disadvantages of natural facilities. But my present tour has conquered that opinion and I am more inclined to think why should not the graduates of this college take to private enterprises of the kinds mentioned above.

Well we often hear of the various arguments put forward by various men, such as want of capital, land etc., but I think these difficulties can easily be overcome if the government will co-operate in this matter either by advancing money or by allotting suitable lands or by both.

We also visited a few farms started by the graduates of this college which gave us ample opportunity of studying difficulties of a practical nature, which we cannot expect in a model farm.

I should like to draw the attention of the college authorities with regard to, firstly the importance of visiting private farms and gardens rather than Government farms; secondly the advantage of combining the vegetable group with the Botany group instead of C and D groups.

* * *

Explanation of Abbreviations used in the Diagram of Prunning.

F. S. G. 1913 = First Season's growth or First growth of 1913.
L. S. = Original Leading shoot.
A. 11 = Point of pruning in April 1911.
F. S. G. 1911 = First Season's growth of 1911.
O. 1911 = Point of pruning in October 1911.
$G\,\frac{O}{11}-\frac{A}{12}$ = Growth from October 1911 to April 1912.
A. 1912 = Point of pruning in April 1912.
G. O. = Growth till October 1912.
O. 1912 = Point of pruning in October 1912.
O. 1913 = Point of pruning in October 1913.
A. 1914 = Point of pruning in April 1914.
Jan. 1911 = Planted in January 1911.
F. S. G. = First season's growth in 1913.
G. O. 1912 = Growth till October 1912.
$G.\,\frac{O}{1911}-\frac{A}{1912}$ = Growth from October 1911 to April 1912.
F. S. G. = First season's growth.
$G.\,\frac{O}{11}-\frac{A}{12}$ = Growth from October 1911 to April 1912.

Note.—(1) Lengths of spurs are sometimes exaggerated.

(2) Numbers show the buds left at each pruning.

(3) The operations from June 1911 to April 1914 are traceable on No. 2 of the original lateral shoot. On this also the final operation is traceable on its branches only.

It must be remembered that all the main branches and the subordinate ones are to be similarly treated.

The B. Ag.

BY

F. J. Kabraji.

SOME people are very particular on small points; such people insist on writing "bag" as "B. Ag." and never omit the dot on the right-hand corner of the B. I am one of the plain downright logical sort who call a bag a bag, and rather despise the people who affectedly call it b......a......g. and write it B. Ag. To give you a piece of my logic whether you say b......a......g or write B. Ag., the sound or the sight of that little group of letters in that particular order, suggests to any man with ·5 grain of Common Sense (after much study I have come to understand that Common Sense is not *always* to be confounded with Common Salt; it remains to investigate the relationship of the 2 commodities.) that useful article of every day life, which has many shapes and makes, and is made for putting thing in. It may be made of crude cloth or polished leather but it still remains for all plain-spoken persons a bag.

Now, in my own thoughtful way, I have expended much brain-energy to discover why Government has at such enormous expense founded elaborate institutions and departments for the sake of numbers of young men who are bent on getting as they say their bags. That, numbers of young men of sound mind and sense, should forego their comforts and pleasures, and practise such self-denial, and work so hard for the better part of 3 years (often much more) at the Agricultural College at Poona and all in order to get a bag is to me a riddle. But when I hear of some of the young men that defer or spoil their prospects of marriage until the time, when after sustained effort, they have *got* their bag, I feel like doubting their sanity. I likewise, wonder that there are not many "scenes" between the lovers, for is it not very natural that the prospective wife should feel slighted to find the best part of the affections of her lover, lavished on a bag?

I may mention, that I have made wide inquiries only to find that the price of the costliest bag on the market is not anything like the prices that the bag-hunters at College pay. The price of *their* bags in *their* opinion is above health, and peace-of-mind, above time and many earthly pleasures, not to speak of the large "fees" they pay.

But there is another mystery. It is a common fact, of unanimous acceptance, that a person with a bag,-other conditions being equal,—is more handicapped in his movements, than one without a bag, and yet these young bag-winners claim that their way in the world is actually made easier by their precious possession !

Then, there are some of these bag-seeking gentlemen who have by consummate genius managed to get their whole world into their bags, and to live in them ! I do not easily give up a riddle, but I confess my inability to tackle this one.

Again, there are others who have lost their physical and mental balance, and developed a one-sided outlook on life, by carrying their bags always on one side !

[*P. S.*]—After writing the above I have heard that B. Ag. stands for " Bachelor of Agriculture". Whatever it may mean there is more sense I believe in trying by 3 or more years of steady effort to become " Husband of 'Agricola'." Don't you think so? *18th October 1918.*

Mr. Arthur Sullivan.

BY

Dr. Harold H. Mann, D. Sc.

Director of Agriculture, Bombay Presidency.

———:O:———

WE celebrate today, as one of the great honours which have come to the Poona Agricultural College, the award of the Military Cross to Lieutenant Arthur Sullivan, a former student of this College, who only left us to join the Indian Army Reserve of Officers in 1917. I am pleased beyond measure at this award, but knowing Arthur Sullivan as I do,–his devotion to duty, his determination to do well whatever he undertakes, I am not surprised. He is bound to be among the best wherever he goes.

I knew Arthur Sullivan as a boy of 14 or 15 at Kirkee. He had been brought up largely in England, but on the transfer of his father, in the Ordnance Department, to Kirkee, he came here. When about fifteen, Arthur came to see me, told me he was very keen on agriculture and asked whether he could join the College. To this I replied that he could do so, but he must first at least pass the Senior Cambridge Local Examination, and that would take him two years. He immediately resolved to do so, went to St. Paul's School, Darjeeling, spent the necessary time and came out brilliantly in the examination he had aimed at.

Then he joined the Poona Agricultural College as a special diploma student. He had difficulties, as the only European student in an Indian college, but from the beginning he was marked out as one of the most earnest and yet one of the most popular students of the College. And I do not know any one who has attended the college in my time who more completely won the confidence of the staff and of his fellow students during his career. A brilliant student, a great athlete (he won the Willingdon Challenge Cup in 1917), and a most attractive personality, every one was sorry when the time came for him to leave in 1917. The confidence of both staff and students was shown by the award to him of the "Ahmed-Mann" medal in 1917, one of the most prized distinctions in the college. He acted as editor of the College Magazine in 1915–16. He passed from the college in 1917, after a very brilliant examination, obtaining the Diploma of the Poona Agricultural College in the First Class, After the war started, he determined to offer himself for service as soon as possible. He discussed with me as to whether he ought to interrupt his studies to go. I advised not,–but as he was an extra-efficient volunteer, he was appointed to the Indian Army Reserve of Officers (on the recommendation of the Officers of his volunteer corps as well as my own) almost immediately after leaving the college, and after a period of training and service in North India, he went to Egypt as an Officer in the 91st Punjabis. Most of his service has been in Palestine, and the action for which he received the Military Cross occurred during the British advance on Damascus. With characteristic modesty he has told neither his father nor myself much about it. But we are proud of him, and we believe that it is only the prelude to greater things. When he returns to agriculture (as I am certain he will, some day) I believe the energy, devotion, and grit which have given him the present distinction will bring him a future of great usefulness in what-ever country he serves.

College News & Notes.

——:o:——

We are glad to announce that we have received a letter from Mr. R. K. Apte, B. Ag. who is now in Africa, managing a Coffee plantation, giving his experience of his stay there. He has concluded his letter thus:—

" Lastly I should like to convey to my fellow students, through you, a bit of my experience. While in the College, *one should try to learn everything that comes in one's way and should never leave anything untouched with the idea that one is not going to do it after leaving the College.* I hardly dreamt while in the College, that I shall be in charge of a Coffee estate."

(Italics are ours.)

We Commend this portion of Mr. Apte's letter to Students of our College for their Serious Consideration.

We are glad also to announce that Mr. G. B. Deshmukh who passed his B. Ag. in the year 1917, from our College and who had the honour to be one of the most successful managers of this magazine, has been awarded a post in Singapur Botanical Gardens on a handsome salary of Rs. 180.

We cannot resist the strong temptation of heartily congratulating Dr. H. H. Mann formerly the Principal of this College, who has been honoured with the Directorship of the Agricultural Department of this presidency! The students of this College, however, have lost in Dr. Mann, a sympathetic principal and a learned and the thorough professor. It is unfortunate, however, that the Managing Committe of this magazine, in future years will probably lose his ripe experience and wide knowledge.

All the same, we are confident that our present principal Prof. Knight has all the capacity and experience to guide the affairs of this College with the same ability.

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Dr. Harold H. Mann, D. SC.,

Ag. Director of Agriculture, Bombay.

THE POONA

AGRICULTURAL COLLEGE MAGAZINE.

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EDITORIAL.

IN the editorial of our last issue we described what the Agricultural Department was doing in connection with the famine situation, and more especially in connection with the famine of fodder which is occurring during the present year. Since that was written the famine has become obviously worse. The people are suffering in a number of districts, Ahmednagar in the Deccan probably being the worst of all; famine works are in full progress in many cases, and the number of stricken people working on them is continually increasing, and will probably still further increase at least until August, when the first of the new grains may be expected to be available.

The cattle are suffering still more. In some districts, notably Ahmednagar, the loss of cattle will probably be sixty or seventy per cent of the number before the war, and we fancy that the loss over the whole of the Bombay Presidency will be from twenty five to thirty per cent. The useless or poor cattle in many districts have now disappeared, and most of those which remain are being kept with every power that the cultivators have. The supply of fodder is however diminishing. Grass can still be got, but the quantity now available is very small, *kadbi* or *jowar* straw has almost disappeared. Prickly pear is proving a stand-by in the worst affected districts, though its careless use has led to much mortality and to a certain pejudice against its use. But a great effort will be made to save the cattle which still remain.

But, if all goes well, the rain may be expected to come in June, and over most of our areas by the end of June there ought to be grass, and on the areas suitable for *kharif* crops these ought to be growing. There will be difficulties in the establishment of these crops. The famine of food has been so severe that much of the grain normally kept for seed has been eaten, and some valuable varieties of grain have been apparently lost altogether. So that there will be a difficulty about seed supply. Further there will be a scarcity of cattle for cultivation, and for this reason much land may remain uncultivated. The very advent of the new grass may emphasise this evil by causing sickness and death among many thousands of cattle.

Under these circumstances, and during this period of recovering from famine, what can the Agricultural Department do? Its staff is small, its arms can only reach a limited distance but the following are lines of action which it is intended to follow;—

1. *Distribution of Seed.*-One lakh of rupees has been spent for seeds, chiefly food and fodder seeds, required for the coming *kharif* and *rabi* crops. In addition a sum of Rs. 16000 has been allotted for preserving the stock of potato seed, which would probably otherwise have disappeared. And much more will be spent immediately for seed purchase. Most of the above amounts have been expended in kinds of seed which would otherwise be likely either to die out or be very difficult to obtain, or in desirable types of seed of the usual crops.

So far as distribution of this seed is concerned, where the stock of seed is held simply to fill a deficiency of ordinary seed then the distribution will probably be made through the mamlatdars, in return for *tagai*. When the seed consists of special varieties which may otherwise die out, the distribution will probably be made direct, as far as possible, to selected cultivators by the staff of the Agricultural Department. But the Agricultural Department probably now hold the most valuable stock of seed in the country.

2. *Mechanical Cultivation.*—It is a matter to be very much regretted that a large number of different kinds of implements, tractors or other for mechanical cultivation were not imported into Western India before the famine. When the probable shortage of bullocks was realised, it was too late to import them, and thus the work which might have been done in cultivating land in the districts where there has been the greatest loss of cattle is very small compared with what might have been. But the steam cultivating plant belonging to the Agricultural Department is to work in the Ahmednagar district, ploughing six inches deep probably costing about Rs. 6/8/- per acre. One tractor plough is now

available and will be similarly used in the Poona district. It is a pity these could not be multiplied by twenty.

3. *Implements for Hand Cultivation.*—After the famine of 1900, Mr. Mollison introduced a number of cultivation implements which could be locally made, and worked by hand power. Of these only the drills, harrows, and hoes were really successful. It is proposed that these should be prepared in all the famine tracts in numbers sufficient to show to the people all over, so that they can be made everywhere if the people show that they want them. In the meantime, experiments are being made at the Agricultural College with new types of hand implements, and these, if successful, will be similarly introduced.

4. *The encouragement of early ripening types of grain.*—In view of the very great scarcity of grain in the country, it is important to get new grain grown in the *kharif* season as quickly as possible. Now the ordinary grains grown, namely *bajri* and *jowar* are not by any means the most rapid ripening grains we have. Every effort by persuation, by leaflets, or by any other methods, will be made to encourage the growth of those that ripen more quickly. Of these the most likely to be generally useful are the smaller millets, and of these *rala* is perhaps the best. Seed of this will be made available on a fairly large scale. Of pulses, *mug* and *udid* are the best.

5. *The loss of cattle when the new grass appears.*– Every year on the appearance of the new grass there is a large mortality among cattle from tympanitis. This year, it is probable that this mortality will be very much greater than usual owing to the extreme emaciation of the cattle at present. Every effort will be made to warn the people of the danger, and to show them the available remedies and how to use them.

Such is, in very rough outline, the programme of the Agricultural Department during the period of recovery from famine. The department has, however, another function, that of preventing future droughts having the same serious effect as the present one on the crops and the cattle. The methods which it is proposed to use may be indicated in a very few words.

The first of these is the regular establishment of a system of fodder storage in *pucca* bales. So far as grass is concerned, this will be managed by the forest department, but as far as it concerns *kadbi*, the matter is to be taken in hand by the Agricultural Department. A lakh of rupees will be spent this year in the first stages of a regular provincial fodder storage scheme. Fodder can also be reserved as silage, a method which it is astonishing has not been used in the past. Ten silos are to be constructed this year as demonstration in so many centres, and we anticipate that, once introduced, the use of silos and of silage will extend rapidly.

Further than this, we must be ready with schemes to utilise the water of the great rivers for irrigation when any great shortage of rain occurs. The rivers should be surveyed now, to see where there is sufficient water for pumps to be planted, and sites for irrigation with such pumps will be found and mapped in the near future. Thus a famine irrigation programme will be established. An endeavour will be made to record the areas where wells have proved themselves satisfactory, and also where they are liable to fail. It has already been decided to spend a good deal of money in placing boring sets at the disposal of local authorities throughout the portions of the Bombay Presidency where they are likely to be of use.

It is proposed to call the urgent attention of Government to the need of a regular organisation for land development so that everywhere the largest possible amount of the water which actually falls may be utilised. This involves among other things a thorough study of the methods of so-called "dry farming" as, they can be applied in Western India. Such study will have to be thorough if it is to be of any use.

Moreover, we know little of the drought resisting plants, especially fodder plants, which already exist here. We know little of the relative drought resisting value of different varieties of cultivated plants. All this demands very careful study.

Such are some of the lines of inquiry, preparation, and action for the future. There are many others in view. But, above all, it is necessary to realise that time has shown that we may expect periodic droughts. We must be then, prepared to meet them, and much of the work of the Agricultural Department must be calculated to make us better able to meet them when they come, whether by growing crops less affected by them, by better utilising the rain which falls, by storing fodder for use in years of drought or by placing ourselves, at the first hint of famine, in a position to grow as much as possible by irrigation, even on land where the crops are normally produced without it.

Prickly Pear as Fodder.

(Revised Leaflet issued on the Authority of the Director of Agriculture; the Superintendent, Civil Veterinary Department; the Collectors of Poona and Ahmednagar; and Rev. A. Norton, Dhond.)

The combined experience at Dhond, at Poona, and in the Ahmednagar and Poona districts leads to the following statement as to the best and safest methods for using Prickly Pear as a food for the maintenance of famine cattle and as a nucleus in the maintenance of *mhot* cattle.

1. *Value of Prickly Pear as Food.*—Prickly pear properly prepared, in the dry weather, is about two thirds the value of ordinary green *jowari* fodder, and can be used safely in replacement of a corresponding amount of the latter.

2. *Burning of Prickly Pear for use as Fodder.*—There are two methods which have proved successful in preparing the fodder. In both cases an intense hot flame is necessary, and one free from smoke. The fruits should be removed before the pear is burned.

(*a*) *Method with Blow Lamps.*—Cut the pear in branches from two to four feet long. Hang it on stout iron hooks about five feet from the ground on a cross beam of wood, by one of the joints,—leaves downward,—so that the lowest part will be clear of the ground. Begin burning from the lowest leaf. The heat from the lower thorns burning will soon set fire to the thorns above, and the whole branch will flare up. All the thorns will not be burnt up thoroughly in this way, and the whole will have to be gone over with the lamp, working upward, to burn what is not properly burnt. Then it will have to be looked over once more to get rid of any stray thorns which have escaped notice.

This is the best way of burning the Prickly Pear, but lamps are now difficult to get and very expensive, while they are liable to get out of order quickly under village conditions.

(*b*) *Method of Lohar's Forge.*—An ordinary *lohar's* forge can be used almost equally well for burning prickly pear. In

> this case the fire is fixed, and the pear in suitable-sized branches about two feet long, which should not be too straggling, is held with the *lohar's* tongs in a sloping position over the flame of a well-blown-up forge. The thorns will catch fire, and those on the upper part will flare up as when the lamp is used. Then the branch is turned over and the other side burnt in a similar manner. If any thorns remain, as for example at the place where it was held by the tongs, the branch must be held over the fire till all are burnt.

As blow lamps are almost unobtainable, the *lohar's* forge is probably the best method for general use this year. It should be fixed up, if possibbe, in a shed protected from the wind.

3. *Preparation of Burnt Prickly Pear.*—When the pear is burnt, it should be rubbed over with a stiff brush or a piece of gunny bag to remove any fine thorns and hairs remaining. Then it should be cut up either with choppers on a log of wood, or with a chaff-cutting machine. When animals are first fed with it, the cutting should be to very small pieces, but, later, the pieces may be up to one or two inches square.

4. *Systems of Feeding Prickly Pear.*—The animals should be *gradually* accustomed to the food, otherwise it may lead to purging or to tympanitis, as in the case of other green fodders.

The following is a good method of using the prickly pear.

(*a*) When the animals are new to this fodder, the following ration should be used :—2 pounds prickly pear with 2/3 pound cotton seed, linseed meal, or any oil cake. This should be given three times a day (making 6 pounds prickly pear and 2 pounds of the other food per day), for the first week. This requires to be supplemented with three pounds of dried grass or *kadbi* per day.

(*b*) After the first week, the prickly pear ration may be increased to from eighteen to thirty pounds per day, according to the size of the bullock or cow, and to the succulence of the prickly pear. Along with this, at least half a pound of dry food, preferably cotton seed or oil cake, should be mixed and given *every day*. A little grazing or, in its absence, about three pounds of dried grass, or *kadbi* should be given if possible, as an addition to the above ration. It is advisable to give a little salt.

Animals in cattle camps should have some exercise, and be watered twice a day.

Mr. Norton has found at Dhond that after cattle have been feeding on the above ration for some time, they will thrive on, prickly pear alone.

5. *Demonstration.*—It is advised that anyone wishing to use this method of feeding should visit a centre where the use of prickly pear is in operation. At present it can be seen and shown at the following places :—

(*a*) The Poona Agricultural College Dairy, near Mariai's Temple, Kirkee.

(*b*) Rev. A. Norton's Farm, Dhond, District Poona.

(*c*) Ahmednagar (under the control of the Collector of Ahmednagar).

No doubt more centres will shortly be inaugurated, and information as to these can be obtained from the Collectors of each district.

6. *Treatment of Animals becoming sick.*—In the event of any animal suffering from tympanitis, purging, or indigestion from this food, a dose of sweet oil (from half a bottle to a bottle) should be given, and another diet substituted for the time being. In cases of severe tympanitis, the Veterinary Department will be very pleased to give every assistance.

If any animal appears distressed, or any salivation noticed, the tongue and mouth should be examined, and if any thorns are found, they should be removed.

Economic Conditions in Some Deccan Canal Areas.

By

Harold H. Mann, D. Sc.

(Director of Agriculture.)

THE canal areas in the Deccan have features of intense importance to co-operators in Western India as well as to all others who have an interest in the economic development of the country. Some of these, so far as I can judge, are unexpected, but the possibility of their being repeated in future similar conditions makes their study worth while at the present moment.

The greater irrigation canals of the Deccan are four, and their relative characters are as follows. I have, in each case, in order to compare the size, indicated the area of "four months' crops" which they are calculated to be able to support :—

(1) The Gokak Canal, which cost 19 lakhs of rupees, and is capable of giving water for 10,000 acres of four-months' crops.

(2) The Mutha Canal, opened in 1873-78, which cost 115 lakhs of rupees, and is capable of giving water for 49,000 acres of four months' crops. (As this canal also provides the water supply for Poona, neither the cost nor the area is comparable with the others.)

(3) The Nira Canal, opened in 1884, costing 99 lakhs of rupees, and capable of irrigating about 1,00,000 acres of four-months' crops.

(4) The Godavari Canal, recently opened, and capable of irrigating about 57,000 acres of four-months' crops.

All these lie in tracts of very small and variable rainfall, most of the character of the rain coming, when it does come, in heavy storms of short duration. Except for the Gokak area, the rainfall varies from twelve inches upto about twenty-five inches per annum, but is generally under twenty inches over much of the area. As a result of the rainfall, the hill-tops and high lands as well as the upper portions of the slopes are usually washed almost free of any fine soil, and hence there are on these positions very shallow stony lands. The drainage channels are deep and highly scoured. On the other hand, however, the valleys are filled with soil of good quality, whose depth largely depends on the narrowness and steepness of the valley as a whole. Previous to the advent of the canals, the wells were usually deep, and irrigation, while it existed in favoured areas, was comparatively uncommon.

We have, therefore, in these areas tracts of country, which before the construction of the canals were famine-stricken and poor, where a fairly good crop could be looked for certainly not more than one year in three, where the ordinary dry crops of the Deccan were grown, where labour was superabundant and went outside to find work, where land was cheap and manure (as in all dry-crop areas in the Deccan) little used, where the villages were small and poverty-stricken but fairly healthy, and where little capital or credit existed.

These remarks apply to all the tracts in question. In what follows, however, I am going to speak more particularly of the area covered by the Nira Canal, which was not only one of the earlier canals, but was brought to a country where irrigation was a new thing, and where it has now existed long enough to enable us to judge of its economic effect. I know this valley well, and I can speak largely from my own knowledge and experience, while to co-operators it has a special interest as it has been, and is, a special field for the activity of the Bombay Central Co-operative Bank.

In the year 1884, the Nira Canal was opened, and the effect on the district which is covered was almost immediate. I have calculated the figures for the area under sugar-cane and under gardens, and also the area carrying two crops a year in the Bhimthadi Taluka (where the greater part of the Nira Canal arrea is situated) at various times, and they are as follows:—

		Area under sugar-cane	Area under garden crops	Area double-cropped
*		Acres	Acres	Acres
1885-86	...	445	999	7,981
1890-91	...	675	2,656	14,464
1895-96	...	2,690	1,423	8,165
1901-02	...	5,823	2,346	19,975
1905-06	...	5,203	1,820	16,665
1910-11	...	6,229	1,246	9,626

* I have taken this year instead of 1900-01, as the latter was the year of one of most severe famines in the Deccan, and this rather vitiates comparison with it.

The effect of the introduction of the canal on the agriculture of the area was not, in the first place, a very large increase in the amount of sugar-cane, but rather an increase in the crops the people had been usually growing like vegetables,—and a larger use of double-cropping. In other words, it was a continuance of previous practice, though on a more intensive scale. But little by little it became evident that sugar-cane was capable of yielding, under irrigation, greater returns than such garden crops or than such double-cropping,—and very gradually the amount of sugar-cane increased. This was partly due to the enterprise of the people themselves, but also, in a considerable measure, to the incoming of a group of cultivators—the Saswad *malis*—who rented the land without any idea of purchasing it, but who were expert sugar-cane growers, and who knew how to make large amounts of money by it.

It will be seen, however, that, from a tract of intensive cultivation, the Nira valley canal area tended to become a land of one crop. Garden cultivation has declined, and the double-cropped area is now little greater than before the advent of the canal. That one crop, however, was an exceedingly valuable one, and, when well-cultivated, gave very large returns. Hence, the land capable of being irrigated and of growing sugar-cane rose rapidly almost to ten times its former value. Areas formerly saleable for Rs. 50 to Rs. 100 per acre became worth from Rs. 500 to Rs. 800, and the result was an enormous expansion of credit.

This very large increase of credit was, however, fully needed. Intensive cultivation of whatever kind leads to a very large demand for money. In the present case, the demand was extreme, for, as grown in the Deccan, sugar-cane needs more floating capital per acre than almost any crop that I know. A man is considered to be unwise who spends less than Rs. 500 per acre on a single year's crop. This demand for money, accompanying the rapid rise in the price of land, caused a large number of financiers or money-lenders, who usually follow closely the growth of high class crops, to settle in the district. It will be seen that the presence of such financiers was necessary, but as usual, when advancing money on a crop, they have charged a very high rate of interest, and bargained to act as brokers for the sale of the *gul* or *jaggery* from the cane. The usual rate of interest in the Nira valley for advances on the cane crop has been 18 per cent.; the usual brokerage rate for selling the produce, I am informed, has been 8·6 per cent.

If I may digress a little, I should like to call attention to two other indirect economic results of the bringing of canal water into the Nira canal area. The first is that it allows much greater sub-division of the ownership of the land to take place than would otherwise occur. Sub-division, to an excessive extent, is at present one of the great banes of Deccan agriculture. But sub-division in practice, if not in theory, must stop when the areas owned are not worth owning. By increasing the value of the land you can make the sub-division of ownership much greater than it was before. The second indirect result has been the creation of a feeling that actually to work on one's holding is rather beneath the dignity of a landholder, and while, before the appearance of the canal, nearly all cultivators would plough and cultivate their own land, it is now usual for almost all but the very small growers of sugar-cane to carry on nearly all agricultural operations by means of labourers. There is, therefore, a greater and greater tendency to depend on labour.

These matters are, however, by the way. The general progress was as follows: Sugar-cane cultivation was found to be capable of giving very high returns. This led to very largely increased land values, and hence to greatly expanded credit. This, again, led to the greater and greater concentration of effort on the one crop, namely sugar-cane, which was able to give the highest returns.

Now, dependence on one crop is always a risky thing. It is risky because the variations in price of a single article, (in this case, *gul* or *jaggery*,) may be so great as to destroy a large part of the profit, and the crop, in this case, is on the land so long that there is little chance of a change in price being foreseen. It is also risky because a single crop is always liable to be attacked with disease or destroyed by unfavourable weather conditions, and, finally, it is risky because land is always liable to deteriorate when grown continuously or frequently to one particular crop. These risks may perhaps be faced with equanimity if a man is using his own capital but if he is paying over 20 per cent. (including the brokerage) per annum for the capital he is employing, and if, in addition, the capital required is very great indeed, the risky nature of the cultivation is much emphasised.

In the present instance, the price has proved much more constant than might have been expected, though there was a time, about ten years ago, when it fell almost to the cost of production. The crop also has been, on the whole, very reliable and the diseases which have ruined the crop in many other places have not done fatal damage in the Nira valley. The land has, however, in many places deteriorated badly, and this deterioration is, if my information is correct, still going on.

In an area of arid land, brought under irrigation, there is always a tendency for an accumulation of salt to take place on the surface of the land, unless drainage is particularly good. And this is particularly the case if the irrigation is intensive, and if the sub-soil, formerly dry, becomes filled up with sewage from the canal or from the irrigated fields. Now, with the increase of sugar-cane cultivation, the irrigation became more and more intensive, little attention was paid to drainage either by the canal authorities or by the people, the sub-soil became more and more filled with water, and the land became more and more injuriously affected by salt. In many cases, the salt increased so much that the land went out of cultivation. Over five thousand acres of formerly cultivated land under the Nira valley is now useless. But, in many cases, even where the amount of salt is not sufficient to cause crops to fail, it becomes more and more difficult to obtain a first class crop, more and more manure is required for the purpose, and hence, the already very high cost of cultivation tends constantly to increase. Closely connected with this matter, too, is another factor which has had, I believe, a very great economic effect. The rise in the sub-soil water has made the canal area unhealthy, and what was formerly a district very free from malaria is now one of the most malarious in the Deccan.

We have, therefore, following on the great concentration of effort, capital, and water on one crop—sugar-cane, a large increase in credit, a large amount of money in circulation, a large return on capital if all went well,—but a condition of things very risky for all but the most financially stable of the sugar cane growers. A year's lack of success places them in the hands of their financiers, from which they can only hope to escape by growing again the same crop. In the meantime, the expense required to get a first-class crop has been getting greater and greater, and hence the chance of a man who *once* made anything but a brilliant success of any particular crop getting over again into financial independence has been becoming less and less. The charges for interest and brokerage have, in fact, been so great, and the chance of the crop giving the highest yield has been getting less to such an extent, that it has been increasingly difficult for a man using other than his own capital to make his crop pay.

There has, in fact, been a tendency for the richer men in the valley, who work on their own capital, still to make good profits, though they acknowledge these to be much less than formerly. Many of the best of these, chiefly the Saswad *malis*, have departed to the more virgin land under the Godavari Canal. Those who remain, however, still do well, tend to accumulate capital, and give an appearance of prosperity to the valley to an outsider. The much larger number, who are dependent on advances for growing their crop but who cannot cease growing it without definitely abandoning their land to their financiers, are, I believe, not making money, but becoming poorer and poorer, and tend to be financially more involved every year.

This may be a somewhat gloomy picture of a valley, where the canal has brought so much wealth, has changed a desert into a garden, and has obtained so many advantages for the people. And I do not wish to exaggerate in the matter. Sugar-cane cultivation will still give good returns with skilful and careful management. But the days when these returns could be got while paying for financial aid at the rate which has been customary are, I believe, gone. To make the industry pay in future will mean far more attention to drainage than in the past, far more care for levelling, far more trouble to get the best seed, far more skill in the selection and use of manure and attempts (as for instance, by the use of the Manjri method of cultivation) to reduce largely the present cost of cultivation.

. I expect the course of events will be more or less the same on nearly all canals, and especially on those which devote themselves to the cultivation of one particular highly profitable crop. Some men will succeed and become rich ; others—and the vast majority—may also do well for a time until the causes I have tried to describe become operative, and they find a declining crop, which they *must* still cultivate, leading to hopeless financial bondage. To introduce at this stage improved credit facilities may help little, unless at the same time you bring in such agricultural improvements as will lower the cost of production, or increase the yield, or improve the quality, so that temporarily, at any rate, the return to the grower may be raised to the old rate. Then and only then, will the improved credit facilities become really operative, and enable the cultivators who have been almost swamped to recover their economic independence.

Food of Birds in India.

BY

Moses Ezekiel, M. Sc.

THE food of birds in India is a subject that has been very little studied. Mr. Mason's laudable attempt † to bring together all the available literature on the subjects, in his great memoir and the supplementing of the same by means of actual examination of the contents the alimentary canal of a large number of birds, has given us a good start, and we have now to work up in greater detail the food of birds in each of the several presidencies and provinces in India. I have recently studied the food of the House Crow, the House sparrow and the parrots and parochets and I propose in this short article to give publicity to a few observations I have been able to make in connection with them.

The Indian House Crow (*Corvus spendeus*) is the commonest and most familiar bird in the neighbourhood of towns and villages. It is omnivorous and Mr. Mason's investigations show that the character of its food is extremely varied. Grass roots, flowers of the silk cotton tree (*Bombax malabaricum*) wheat, oats, peas, linseed with centipedes, small worms, ants, lizards, melons and pumpkins, frogs, termites, maize grains, Ficus fruit, species of beetles and cutworms all come within his diet.

From my personal observations in the Konkan, I find the crow becoming a pest on various fruit crops according to the season. From March to June he is a great pest on water-melons and mangoes. Papaya fruits are attacked just when they are ripe enough to be taken down, and the destruction so caused is very great throughout the year. The crow is the first to observe the yellow tinge on the papaya, puncture it at the spot and tunnel the whole fruit, eating voraciously the most lucious portion of the fruit in less than a minute.

At present foxes and wild pigs are great nocturnal pests on root crops and melons, and during the day the crow carries on its ravages on the melon fields and seems to hold its own. Little has been done hitherto to protect these crops from the three pests indicated, either by the authorities or by the people themselves.

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† Mem. Dept. Agric. Ind. (Entom. Sec.) Vol. III.

The only protection devised by the people has been the small apparatus for making a loud detonation with nitrate of potash and sulphur. This has now been prohibited, but an equally good detonating mixture has been made available.

In the mango season the house crow destroys a hundred times more fruits than he actually eats, for in the attempt to eat the mango he most often than not, breaks the stalk. The mango falls to the ground and is either picked up by children or eaten by squirrels or rots in among the dry leaves which are allowed to accumulate under the shade of the tree.

I am now in Allahabad, and here on our farm, the crow seems to be a great pest on *jowari* and *bajri*. Early in the morning it goes out in search of scraps thrown by the villagers round about, and then comes out into the fields at about ten o'clock. After an hour it disappears only to come back at four in the afternoon and takes a desperate fill before going away to roost. The *mynas*, orioles, parrots and parochets, cuckoos and magpies, as well as the mad birds all join it at this time of the day and fill themselves from the same sources. I have watched these birds from day to day and invariably found the maximum number in the *jowar* fields between 4 and 4-30 p. m. in December when the sun sets at 5-30 p. m. or thereabouts.

The parrot seems to delight in *jowar*, *bajri* and maize, and from the number of ripe grains seen on the gound at the time of ripening, I am convinced that the parrot does more damage by breaking off the seeds than by actual eating.

The house sparrow is always with us eating every grain we produce to its heart's content. It does incalculable damage to all our cereal crops. Last year, in July and August and the early part of September at a time when no grains were ripe for it, it took desperately to guavas. I watched the sparrows throughout the three months named and saw them working havoc on the guavas. The garden *mali* and his assistants bitterly complained of the harm they were doing and thus confirmed my observations. The parrots could be scared away by shouting and were easy to deal with as they always moved in flocks, the sparrows were having their own way all along, sometimes singly, at other times in great flocks. Their small size and silent ways are greatly in their favour from their own point of view.

In addition to the harm they do to the cereal crops, parrots partake freely of all fruits. Guavas, mangoes, papaya, figs, tamarinds, also flowers and leaves are all freely eaten. The Rose-ringed Parroquest (*Paleornis torquatus*) is also very destructive to most kinds of grain and fruit. Mr. Mason describes it as 'the greatest bird pest we have in India.' Most kinds of grain as well as fruit in gardens is attacked by this bird. It would be worth-while estimating the amount of damage it does to the Fig crop in the Poona district. On our farm at Allahabad it is a veritable nuisance.

The Spotted Dove (*Turtur suratensis*), the Indian Ring Dove (*Turtur risorius*) and the Indian Blue Rock Pigeon (*Columba intermedia*) are voracious grain eaters all over India. "Barley is a very favourite food of the spotted Dove" says Mr. Mason, but on our farm at Allahabad it attacks wheat, every cultivated species of mustard both green and ripe, *Arhar* (*Cajanus indicus var. bicolor*) peas and even linseed. It may be said parenthetically for the information of the reader that wheat, peas, gram, *Arhar* and mustard are usually grown as a mixed *rabi* crop in the United Provinces. Peas, mustard and linseed are invariably mixed in the same plot. The Spotted Dove and the Indian Ring Dove are the commonest doves of the plains and are always seen in large numbers in cultivated areas. They cause a great damage to the grain crops on our farm.

'Bari' Goats in Sind.

BY

S. Jafferali,

Ag. Divisional Superintendent of Agriculture, Sind.

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THE number of varieties of goats in Sind is very large. The following are the chief among these, together with their special characteristics.

1. *Leri.*—These goats are chiefly black, but sometimes (though rarely) piebald or red in colour, with long shaggy hair, long flapping pendulous ears, roman nose, horns curved on themselves in a peculiar manner, and standing high. They are good milkers, quiet, with soft elastic udder and fine projecting teats. They are deep in the chest and wide about the haunches.

2. *Kamori.*—This breed does not differ widely from the *Leri* except that the animals are better built, are of an exceptionally large size, and have very long flapping pendulous ears, touching the ground when the animal moves about with slightly drooping head. It is recognised as an excellent milker.

3. *Kachali.*—This variety also resembles the *Leri* but it is only medium-sized and is ugly. It is chiefly obtained from Jhudo and Badin in South Sind and from the margin of Kutch. It is only useful for the market.

4. *Kuri.*—This appears to me to be a cross between *Bari* and *Takro.* It is seen in almost every colour ; black is rare, white, piebald, red, and brown are common. The distinguishing characteristic of this variety is the small pointed ear. It is a poor milker, and is only useful for the market.

5. *Lurki.*—This is medium sized, mostly black, though various colours are found. The characteristic feature is the round pendulous lobules, two to three inches long, hanging on both sides of the throat below the ears. Hence the name *Larki.* It is a better milker than *Kachali*, *Kuri*, or *Takro.*

6. *Takro.*—This variety is a small well built type from the hills, and is mostly used for market. The horns are twisted and good looking. The animals are mostly black and piebald, shaggy, and with a tuft of hair on the forehead.

7. *Bari*.—The word *Bari* is derived from *bur* meaning a desert, and indicates the fact that it comes originally from desert and mountain valleys. People vary in opinion as to the actual origin of the breed, and there is a local opinion that it is a cross between a mountain goat and a deer!

The *Bari* goat is usually a large, beautiful, well-built animal with fine acute pointed hoofs. The legs are thin, the horns erect and finely twisted, the eyes large and angular, the nose prominent. It is a good milker, and it gives specially sweet milk. The *bari* goat is never black, though it may be light brown, deep brown, piebald, skewbald, or white. White animals are however very rare.

During my inquiries about *bari* goats, I have gathered information from Arabic sources. It seems that this has been a favourite breed with mussalmin prophets. Pure *bari* goats are said to have a light brown tint with clear white colour on the stomach beneath. It is added that the flesh of a variety found in Arabian valleys and termed *bari-mushki* is not tasty. Most people in Sind, it is said, have not the genuine *bari* goat, and crosses (provided they look well) are often termed *bari*. The pure strain in Sind is termed *bari-khushi* and it seems probable that this is closely allied to the *bari-mushki* of Arabia.

Pure *bari* goats are very rare in Sind, and I think they can only be found after much search and difficulty. After many inquiries I find that good animals are obtainable from the following places in Sind,—Shahdad-kote taluka, Warah taluka, Sehwan subdivision (particularly Johi, Hangar, and Bajar), Kotri subdivision (particularly Manjaand and Thano Bulakan mahals), Sakrana and Moro talukas.

In an interview with Khan Saheb Sarai Imambux-khan Jatoi of Moro he promised to get me a few animals of pure strain from Moro taluka, as he said that some Baluchis there rear these animals. I have also learnt that Hon. Mr. Alhandoshah of Naushahro taluka and maintains a small herd of pure strain. The average price of two year old animals varies between Rs. 6 and Rs. 8. The female is usually worth eight annas to one rupee more than the male.

Nitre Industries in the Ahmednagar District.

BY

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District Agricultural Overseer, Ahmednagar.

WHILE moving in the Ahmednagar district for agricultural work I have come across, on a number of occasions, the industry of preparing saltpetre from the *gutter* refuse of the villages. It is generally considered that this industry has almost entirely died out, but this is not the case, though the method adopted is very rough, and crude, and a good deal of energy is wasted in the production.

The *gutter* refuse termed "*Lona*" is first collected from the streets and lowlying spots where it has collected, and carted to a small hillock or other raised ground near the village. A Government tax of Rs. 10 to 15 per season is levied upon the operator for collecting his material.

A hill of white earth is usually considered as the most favourable spot for the work, and it is essential that water should be found quite close to the spot. On the top of the high ground, two to four *kachha* tanks are made with ordinary earth. The sides are lined with stiff clay, and the depth of the tanks is about two and a half feet. The bottom is rammed as hard as possible. One side of the bottom of each of the three tanks is usually made up with lime, whence it is connected with the reserving tank (see below) by a slanting channel. Sometimes a small sieve is placed at the mouth of the channel so that any mud otherwise likely to run into the receiving tank might be stopped.

The second or receiving tank, is located nearly five feet lower than the tanks just described and it is lined with lime plaster all round. This tank is shallow (one foot deep) with a flat bottom, and is divided into several compartments.

In the month of November, the manufacturers, mostly Paradeshis and Mohamedans, commence their operation by scraping the surface from old mud heaps, mud buildings and waste ground and *nalas* where refuse has been deposited and where there appears to be a thin white efflorescence. After this has been carted to the hill, the operator turns this material into mud by pouring water on the dust and mixing it thoroughly with the feet. The mud is then put into the first tank of the series of tanks described, and saltish water allowed to run from it into the receiving tank. The mud is allowed to remain in the tank for nearly twenty hours and then it is replaced by fresh material. This process is continued for months together until the stock of suitable silt is exhausted or until there is no space for holding more liquid in the receiving tank.

The saltpetre-liquor thus obtained is allowed to evaporate in the flat tank by the heat of the sun. The liquid appears reddish in colour as it is usually mixed with oxides of iron and vegetable matter. Evaporation is very slow and sometimes it takes a full month for the evaporation of the solution and the crystallisation of the crude nitre.

No attempt is generally made to refine the nitre and consequently there is a good deal of impurity in the product. Moreover as the operator is not aware of percentage of nitre which his material contains and as he has solely to depend upon the heat of the sun for evaporation, the output is rather small. The manufacturer informs me that he gets from two thousand to three thousand pounds of saltpetre from one village during the period of six or seven months (November to May) while the operations last.

This nitre is usually sold at fifteen to twenty pounds per rupee and is mostly utilised for the preparation of blasting powder or gunpowder. It is not possible as yet for me to state whether this saltpetre will be useful for manurial purposes as the analyses are not yet completed. But I hope that it can be advantageously utilised for manure when the prices of ammonium sulphate have gone as high as four pounds per rupee. To me it appears that the industry is worth encouraging in these days of industrial development, with, of course, improvements in the process.

From the description given, it is obvious that the process used is extremely crude, and especially, it would seem, that evaporation by artificial heat should be introduced, and that some form of filtration of the liquid from the first series of tanks might be employed. The purification of the product is also essential if a really satisfactory industry is to be established. Facilities for the analyses of the original material employed, would help the workers much by giving them information as to whether the extraction of a particular sample of earth would pay.

The industry, as I have described it, will be found in the villages of Loni, Mamdapur, Savalvihor, Rui, Limgaon, Brahamangaon, Khandala etc. of the Ahmednagar district. There is no reason to suppose that they have any advantages over many others for the preparation of salt-petre, and if the industry is developed it is probable that the district could turn out enormous quantities of salt-petre both for manure and for blasting purposes.

PART III

An Ecological Study of the Chatersinghee Forest Reserve.

BY

Moses Ezekiel, M. SC.

Study of Trees.

THE following list of trees found on and round the Chatersinghee Hill indicates the character of the forest vegetation which has developed during the thirty to forty years during which this has been a forest reserve. In no part can the tree growth be said to be thick. In most parts it is extremely sparse and scattered.

Acacia arabica, Willd. A moderate sized to large tree, of the dried parts of the plains of India, largely found in Sind (on tracts irrigated by the Indus) the plains of the Punjab and the United Provinces generally. It is, however, perhaps the commonest tree in India. Bark rough with narrow longitudinal fissures. Heartwood, pale red, when fresh cut nearly colourless, on exposure turning reddish brown. The spines of the Poona variety known as *Vedi babul* are very stout and up to 2½ inches long.

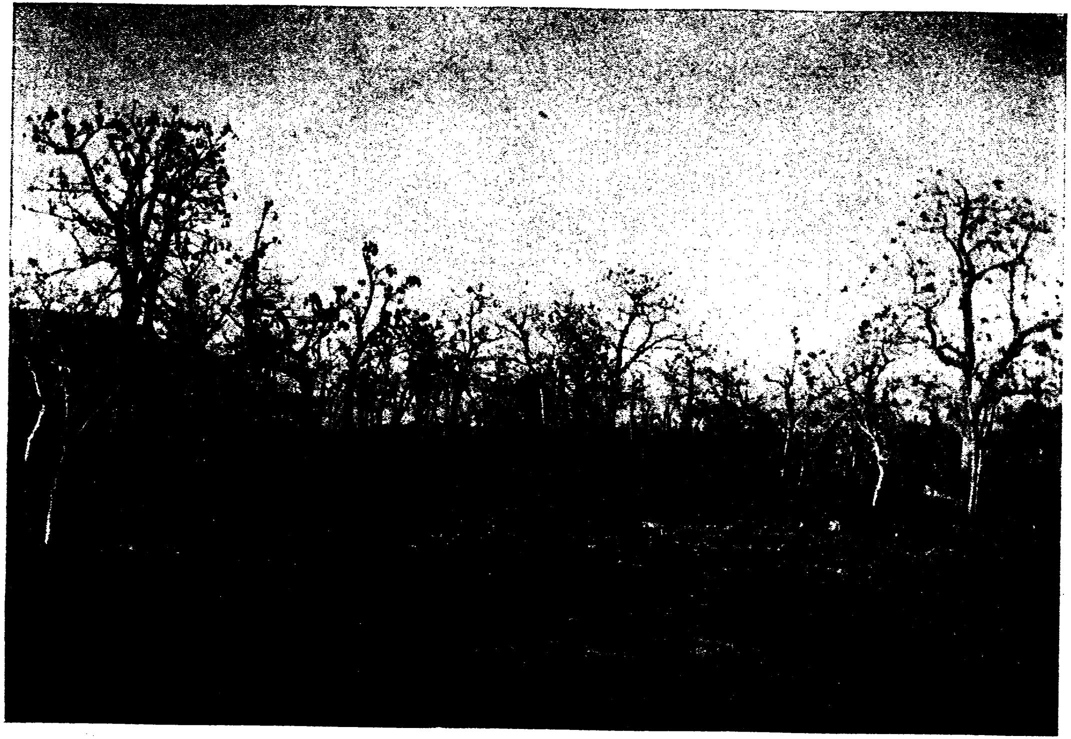
The roots are very deep. In the Poona district this tree is very common along the coast banks of rivers, streams and canals and in soils derived from the various trap hills of the district.

Terminalia tomentosa, W. & A. A large tree common throughout India and Burma. Trunk tall, regularly shaped, bark black deeply cracked, heartwood hard, dark, purplish, brown, mottled with darker streaks, often nearly black.

This tree thrives best in heavy clay soil. The fruit ripens from February to April, when the leaves are being shed simultaneously.

Cochlospermum Gossypium, DC. This very characteristic tree of the area under study is a soft wooded deciduous tree with a few thick short branches. The flowers are four to five inches in diameter, golden yellow. The capsule is pear-shaped and three to four inches long.

This tree grows erect on the slopes but spreads fairly well on the top of the hills, where it has formed an almost pure stand. Order of branching 3 to 6 on the slope, 6 to 9 on the top. Number



Stand of Cochlospermum Gossypuime on the top, South of Vetal Hill.

The barren Western Slope of the Chattarshingee Forest Reserve.

of leaves on a branch 6 to 22. The capsule does not fall but remains long on the tree in a pendent position, where it dehisces longitudinally when the dry winds of April and May are constantly blowing. The kidney-shaped flossy seeds are thus scattered far and wide from west to east. The light rains of June are inadequate for the germination of the seed. No seedlings of this plant could be seen on the hill even till the middle of July. The tree flowers between January and June.

Boswellia serrata, Roxb. This tree, also very characteristic, is a deciduous middle-sized tree with a spreading flat crown. Bark nearly half an inch thick, greenish, ash coloured, peeling off in thin smooth flakes. Fruit three valved, the valves separating from the dissepiments which remain attached to the axis. Seeds three, enclosed in heartshaped stones attached to the inner angle.

This tree is found in the sub-Himalayan tract from the Sutlej eastward and in the Deccan it appears to be almost limited to the strip of country within twenty miles of the western ghats. It is associated with open forests and is often gregarious. The leaves fall in March or April, and the new foliage appears in June.

The exposed roots give off fresh branches, especially at a distance ten or fifteen yards from the trunk of the tree. It flowers when the tree is leafless, and does not stand strong wind.

Odina, Woodier, Roxb. This large deciduous tree, which is common in deciduous forests throughout India and Burmah flowers from February to April when the tree is leafless, and on the Chatersinghee hill it fruits from March onward. The reniform drupe remains long on the tree. The tree is leafless from January to June.

The fruits are heavy and remain in large numbers, near the roots of the trees. They do not dehisce and there is no special adaptation for dissemination of the seed. Order of branching 5 to 9.

Dolichandrone falcata, Seem. A medium-sized tree. The fruit, which remains long on the tree till the end of June, dehisces in the dry months of April and May, and the flat, light, winged seeds are scattered far and wide by the strong breezes. Order of branching 5 to 9. Only scattered examples are found. It flowers from April to June.

Anogeissus latifolia, Wall. The full grown tree shows a prominent bark which comes off in hollow half-cylinders, the maximum size of pieces seen on the hill being seven inches by thirty six inches.

The fruits are attached to the apices of the branches and being light are scattered well. The light rains of June are sufficient for the germination of the seed, as noted from the large number of seedlings seen under the trees on the eastern slope. A large number of fruits are destroyed by fire. The tree is bare during the greater part of the dry season. In November the foliage begins to have a copper tint: it is shed in February and the young leaves come out in May. It flowers from May to August, sometimes from November to February. The latter is true of plants on the hill.

Grewia asiatica, Linn. A middle-sized tree, bark greyish white or greyish brown, sapwood whitish, heartwood small, irregularly shaped, dark brown.

Aspidopterys cordata, A. Juss. A slender climber, young parts tomentose. It is common on the west coast of India and on the western ghats from Bombay southwards. It flowers from September to November.

Lagerstroemia parviflora, Roxb. This is a large tree fifty to seventy feet high, not common in the area studied.

The fruit does not fall and so the winged seeds are scattered to a considerable distance by the strong winds prevalent in the hot months.

Schrebera sweitenioides, Roxb. A middle-sized deciduous tree. This tree flowers from February to April when the fruits of the previous year are dehiscing. The capsules dehisce in a pendent position and the winged seeds are scattered to a considerable distance.

No seedlings of this plant could be found on the hill from June 1916 to October 1917. The small rainfall and the nature of the soil seem to be unsuitable for the propagation of the plant by seeds. Artificial watering or culture in a forest nursery seems to be necessary for the successful growing of the plant in the area.

Heterophragma Roxburghii, DC. A large tree, not common. The fruit remains pendent on the tree and dehisces in April and May. The thin, flat, light, winged weeds are blown far and wide by the strong breezes of April and May.

Acacia leucophlaea, Willd. A deciduous thorny tree, trunk often crooked and gnarled. Bark grey or light brown, when old almost black and very rough. The plant shows numerous galls. It flowers from July to September.

Stand of Boswelha serrata on the South Slope.

Zizyphus jujuba, Lam. A middle-sized tree quite common. Branches drooping, armed with stipular spines, equal, or one straight and the other bent. This tree flowers from April to September, and fruits from December to March.

Zizyphus EOnoplia, Mill. A scrambling, often climbing shrub, prickles short sharp, often solitary,

Zizyphus xylopyra, Willd. A large straggling shrub, or small tree, on good soil often unarmed. It is conspicuous during the greater part of the year by its hard globose seed.

Osyris arborea, Wall. A twiggy shrub or small tree, as a rule glabrous, branchlets three sided, with prominent sharp angles.

This plant is very liable to injury by the grazing of goats and by fire. The underground portions, however, remain dormant till the commencement of the rains and give off-shoots which grow very rapidly at first. Some of these labelled and watched were seen to grow a length of twenty five inches in twenty seven days.

Capparis grandis, Linn. A small tree, generally unarmed, trunk thick, short branches and leaves softly tomentose beneath.

The young shoots and leaves are covered with olive green tomentum. This tomentum serves to retain numerous dew drops on the leaves due to surface tension. The tree is rare on the hill, but it seems to be much more successful on the alluvial area, at the base of the hill.

Randia dumetorum, Lamk. A large deciduous shrub or small tree, armed with stout axillary spines 1 to 1½ inches long.

On the hill, the plant flowers at the commencement of the warm season, and is in fruit by the end of May. In the Ganeshkhind Botanical Gardens, Kirkee, this plant was found still in flower at the end of June. It seems that owing to the desiccating conditions prevalent on the hill the fruiting of the plant is forced. This plant is found growing very plentifully on the ridges of rocks at Mahableshwar. The tough nature of its wood, the thorny branches, the deciduous nature of the leaves and the coriaceous foliage make it specially suitable for exposure to high winds. The stem has a thick bark which is leathery in texture and comes off in transverse parallel strips.

Morinda citrifolia, Linn. A large shrub or small tree, glabrous.

Morinda tinctoria, Roxb. A small or middle-sized tree. Usually pubescent or tomentose, bark spongy, deeply cracked, greyish yellow.

Grewia laevigata, Vall. A small or middle-sized tree. The leaves are renewed in April, and it flowers from June to October.

Fluggea leucopyrus, Willd. A rigid thorny shrub, the leaf and flower-bearing branches terminating in sharp spines.

This plant and Gymnosporea serve as a protection to Osyric arborea against destruction by goats. The flowers open in the evening and give out a carrion-like stench. They are visited by nocturnal insects. The plant is a powerful petrophyte sending its roots in rock crevices and bursting the rocks asunder.

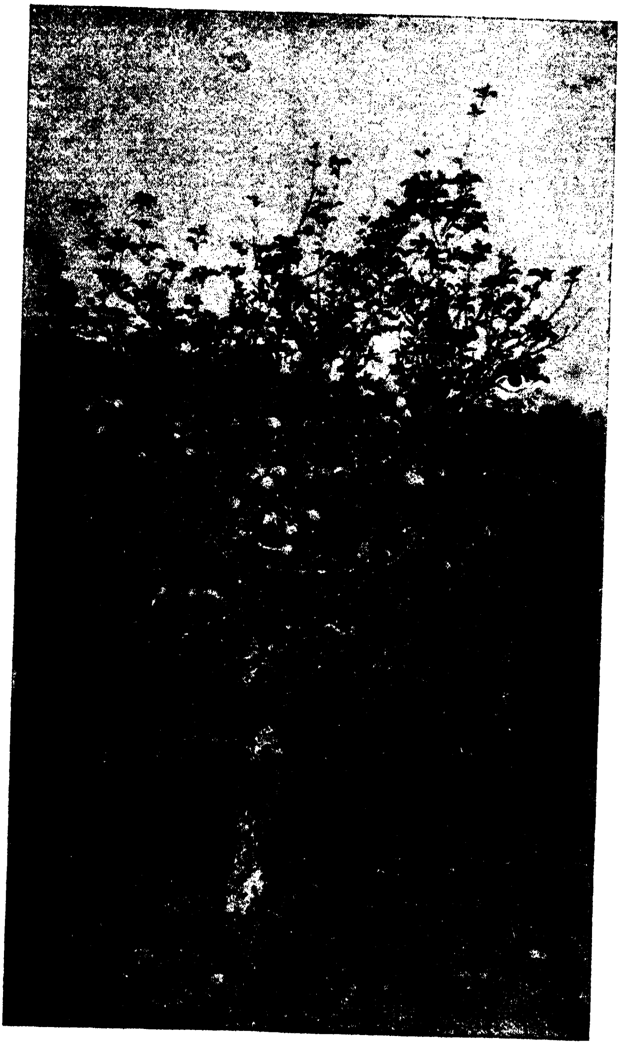
Gymnosporea montana, Lawson. A tall shrub and under favourable circumstances a small tree.

The juvenile branches, which bear a disproportionate number of leaves, remain in a pendent position, the whole of the branch being coloured red by the deposition of anthocyanin pigment.

Ehretia asper, Roxb. A middle-sized tree pubescent or glabrous, branches whitish grey. The old leaves are shed in January and February. New foliage appears in February, March and April. It flowers either before the young leaves appear, or at the same time and sometimes before the young leaves are shed.

Mimosa hamata, Willd. A much branched armed shrub, branches downy, furnished with numerous straw-coloured curved or straight prickles.

Carissa Carandas, Linn. A large evergreen shrub with a short stem. Bark light grey, scaly. Flowers white, odorous.



Randia dumetorum गेळा.

Micro-organisms in Relation to Agriculture.

BY

S. L. Ajrekar, B. A.,
Professor of Botany.

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I

INTELLIGENT farming is dependent on a thorough grasp of the principles of the various sciences which contribute to the formation of the great science of agriculture. The importance of time-honoured sciences like Chemistry, Physics and Botany in this respect is indeed easy to recognise and has been so recognised for a long time. The same cannot be said of the later developed sciences or rather branches of the older sciences—Bacteriology, Mycology and Protozoology all more or less recent developments of the science of Biology which may be conveniently referred to by the term Microbiology. The object of the present paper is to point out the importance of Microbiology to the agriculturist. This would be best done by giving some idea of the nature and functions of micro-organisms, (which form the subject of microbiology) and by a brief discussion of their relation to agriculture.

Now what are micro-organisms ? They are animals and plants of such extremely minute size as to be seen well only with the aid of the microscope. It is obviously impossible, in a single article, to touch more than the fringe of so vast a subject and it is necessary to introduce a limitation and to consider here only those micro-organisms that are of special importance to agriculture. Such are the organisms familiar now to most people under the names *Bacteria*, *Yeasts* and *Fungi*. All these are members of the vegetable kingdom. It must not be supposed, however, that animal micro-organisms are not important to the agriculturist. Our information on these latter is, however, comparatively scanty and in the interests of simplicity of treatment it is necessary to leave them out from consideration in this article.

Now let us briefly describe some of the characteristics of Bacteria, Yeasts and Fungi, so that we may understand what kind of plants we shall be dealing with in this article. They are all micro-organisms belonging to the Cryptogamic or Flowerless division of the vegetable kingdom. The plant-body in all of them, is extremely simple in organisation. There is no differentiation into root, stem and leaves, as in the higher plants. The bacteria and yeasts are most of them unicellular organisms, though occasionally several individuals may be united together in chains or filaments or colonies. The plant-body in the Fungi is typically filamentous, the filaments being unicellular or multicellular and often èlobarately branched. The processes of absorption and assimilation of food takes place all over the plant body in all the micro-organisms named, there being no localisation of these functions in definite organs. Reproduction takes place typically by a process of splitting or fission of the organism into two in Bacteria, by budding in Yeasts, the buds sooner or later separating and forming independent individual, and by spores or special reproductive cells, sexually or asexually produced, in Fungi.

The most important difference which Bacteria, Yeasts and Fungi present from the plants we recognise as such, consists in that they do not possess the green pigment chlorophyll which characterises the latter and which gives the green colour to leaves. The absence of chlorophyll determines the most important physiological peculiarity of these micro-organisms namely, their incapacity to build up, out of simple inorganic substances like carbon-dioxide gas, and mineral salts, elaborate organic substances like starches and sugars, which the green plants are able to do, by means of the chlorophyll and using the energy of sun-light. Bacteria, yeasts and moulds are, therefore, obliged to depend on other organisms-plants or animals for the supply of elaborate food-substances. When the micro-organisms obtain the organic substances required for their nourishment from living organisms, they are described as Parasites and when they live on dead organic matter, they are described as Saprophytes. It is this physiological peculiarity, this necessity to live at the expense of living or dead organisms that makes these micro-organisms so important in the economy of nature. Among parasitic organisms Bacteria and Fungi are well-known as causes of dangerous epidemic diseases like cholera, typhoid, Bubonic Plague, and tuberculosis of animals, and rusts, smuts and mildews of plants. But by far the largest number of micro-organisms are saprophytes *i. e.* live on dead organic matter and these are engaged, day and night, in performing a most useful function in nature that of clearing the earth of the *debris* of dead bodies of plants and animals. They are in fact the scavengers of nature and but for their good work, the earth would have been long ago rendered unfit for any life. The phenomena known under the various terms Fermentation, Putrefaction, Decay and Decomposition which bring about this scavenging or cleansing were until recently supposed to be due to purely chemical forces—to slow oxidation—but modern study has revealed that they are the result of biological–micro biological forces. If micro-organisms can be kept from them, vegetables will not rot, animal carcases will not decay, sugar solutions will not ferment and many other similar changes will fail to appear.

It is not possible in this paper to enter into a detailed discussion of the processes of Fermentation, Putrefaction and Decay. It is sufficient to state simply that these are all closely related processes, being progressive chemical changes taking place under the influence of special organic substances called Enzymes or. ferments, which are present in small quantities in the fermenting mass. These ferments are secreted by micro-organisms. Some of them can only work in association with the organism secreting them, (organised ferments) while others can work even apart from the producing organism (unorganised ferments.) They work under certain conditions of temperature, and themselves remain unexhausted throughout the vast chemical changes they bring about. Putrefaction, Decay and Fermentation all result in the liberation of simpler chemical substances from the highly complex combinations in which they exist in the plant or animal body.

It has been mentioned above that Micro-organisms are all extremely minute in size and cannot be recognised except with the help of the microscope. How minute they can be will be realised when it is stated that Bacteria numbering ten times the population of Bombay could be comfortably accommodated on a square inch of surface ! Or that a few hundreds of them could easily be placed side by side on the head of a pin !

It may be questioned how such extremely minute organisms bring about the stupendous changes above referred to trading to clearing the earth of the accumulated debris of dead bodies of innumerable plants and animals lying every moment about us. The answer is that the minuteness in size is compensated for by the largeness in number and by the rapidity of reproduction. The life history of the individual micro-organism is completed in a very short time—often within a few hours—and the rapidity of reproduction may be illustrated by one or two examples. A single cholera bacillus if introduced into a suitable medium will rejoice in a progeny of 1600 billions in 24 hours ; or, a single anthrax bacillus introduced into the blood is capable of reproducing, as regards numbers, four times the population of Bombay !

Some important factors in GUL manufacture.

By

R. G. Padhye, B. Ag.

Sugarcane Specialist Manjri Farm.

THE subject of *gul* manufacture forms a specialized branch of intensive farming and is one of the most important problems to cane-growers. During the course of the last few years numerous enquiries pertaining to this subject namely the best method of preparing *gul* and the precautions that are required to be taken in order to enable a farmer to prepare *gul* of good quality were pouring in. In some cases complaints used to come that no *gul* could be formed but the product turned out was molasses ; in some, the *gul* was sticky and not crystalline and in others the *gul* was blackish in colour and so on. Sugarcane being a crop involving an expense of about Rs. 400 to Rs. 500 or more per acre, every cane-grower is particularly anxious to turn out good *gul* as the return mostly depends on the quality of *gul* that is turned out. Otherwise there would be a tremendous loss to the cultivator. The manufacture of *gul* requires a special knowledge of the subject and for a beginner who is doing sugarcane farming, this knowledge is quite essential to conduct farming successfully. It is with the hope that, (the information given here may be of practical use to the readers of this Magazine, that I venture to put before them what has been done so far on Manjri Farm where this question has received special attention.

Before the actual method of *gul* preparation is dealt with, a word as to how the quality of *gul* is judged would not be out of place. The *gul* is generally priced in the *bazzar* according to its colour, hardness and crystals. It is generally known that a light coloured *gul* fetches a high price in the *bazzar*. Hardness is generally looked up to from the point of its keeping quality, as, hard *gul*, would keep better than soft *gul*. Besides soft *gul* will not stand rough handling during transportation in railway waggons and broken blocks are always refused by the merchants in the *bazzar*. *Gul* having good crystals, would fetch a high price in the *bazzar* and would indicate that it was well manufactured and would keep longer.

Sweetness is sometimes looked up to in the *bazzar*, as many times, especially in salty lands, where cane is grown the *gul* tastes salty and is not well valued in the market.

In the laboratory the above points are determined by the analysis of *gul*. Colour is often studied by means of an instrument called the Tintometer where some arbitrary standard of colour has been taken as the basis for comparison. Hardness is seen from the moisture content that is present in *gul*, which is mostly affected by the temperature at which the pan is struck, crystals or richness, by percentage of cane sugar that is present in *gul*. A good quality of *gul* on an average should generally have the following composition:

1	Polarization	... +73· 6	
2	Moisture	... 9·15	per cent.
3	Sucrose	... 76·82	,,
4	Reducing Sugars	... 10·40	,,
5	Ash	... 1·35	,,
6	Co-efficient of purity	... 84· 6	,,
7	Tintometer readings of 5 per cent. *gul* solution.	*orange 1·32 yellow 4·27	

It has been found that the moisture in *gul* is mostly affected by the temperature at which the pan is struck, while sucrose and reducing sugars in *gul* depend on the quality of cane and the method of manufacture of *gul*. The reducing sugars are important from the point of keeping quality as these absorb moisture in the monsoon from the atmosphere and make *gul* liquid. The lower the amount of reducing sugars, the better the keeping quality. The Ash content (Mineral matter) is affected by the salts that are present in the soil. It has been found that the salts present in the soil considerably affect the composition of juice and in turn affects the quality of *gul* as it prevents some part of the cane sugar from being crystallized. The analysis given above is an average of the Pundia variety grown in the Mutha valley.

The quality of *gul* would be affected by so many factors that special attention will have to be paid to every one of them. These are

1 Ripeness of the cane
2 Quality of cane

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* Orange is a mixture of yellow and red of equal depth.

3 Period that would lapse from the time of cutting of the cane to boiling.

4 Method of boiling.

1 *Ripeness of cane* :—It has been already shown in this magazine (see article on 'determination of ripeness in Pundia cane' Vol. VI No. 1) that ripeness of cane is one of the chief factors that would affect the quality of *gul*. This is evident as there is a great difference in composition of a ripe and an over-ripe or an under-ripe cane. When the cane is ripe, it contains the maximum amount of canesugar (crystallizable sugar) and a minimum amount of uncrystallizable or reducing sugars. Naturally the resulting product would contain a great amount of cane sugar and a low amount of molasses. Reducing sugars (or molasses) do not crystallize themselves, but in the presence of organic acids which are present in juice, invert some part of sucrose into invert-sugar (mixture of equal parts of glucose and fructose). This inversion would be much less when the juice contains a low amount of reducing sugars as is the case when the cane is ripe. In an unripe or an overripe cane the percentage of reducing sugars is very high. Besides when cane is harvested when ripe, a maximum amount of outturn can be recovered. This is particularly true when sugar is to be manufactured because in that process it is the cane sugar that is arrived at. *Gul* is total solids minus the albuminoids which are removed in the form of scum. When cane is ripe, it contains the maximum amount of total solids and the quantity of *gul* recovered is more. This is one of the factors which has been so often neglected by the cane-growers that many times they have been put to a great loss by crushing an unripe cane. The ripeness is determined by means of a Brix saccharometer. The details of actual method are given in the Departmental leaflet No. 4 of 1914.

2 *Quality of cane* :—The condition of cane, affects the quality of cane. As for instance, when the cane is lodged or when the eyes of the cane are sprouted or when it is diseased, the composition of the cane is affected. In lodged cane the percentage of canesugar does not go high and the reducing sugars remain high. It has been found that when cane is lodged, it is better to harvest it as it would no longer improve in composition. When cane lodges in its younger stage which sometimes happens on account of overmanuring or shallow planting or due to both the causes, it becomes a difficult matter to make the cane sufficiently ripe for harvesting. In cold

weather *i. e.* in winter such cane would keep well but would deteriorate fast in the hot weather. It is therefore better to harvest a lodged cane as early as possible.

The following figures will show the difference in lodged and standing cane from the same field, each being the average of four samples.

	Brix	Sucrose.	Purity.
Sound cane	19·94	17·28	86·4
Lodged cane	17·56	14·12	80·0

It is evident from above why lodged cane does not form good *gul.*

When the eyes begin to sprout, some of the canesugar is converted into reducing sugars in which form the bud utilizes the sugars for the growth. Such cane would naturally contain more molasses. Many times the cane is uprooted instead of being cut for harvesting. This brings in a bottom part of the cane lying in earth where the eye-buds and roots are already sprouting.

This part therefore contains more reducing sugars, and should be avoided for crushing. Besides with this part some earth is taken to the crusher which mixes with the juice and gives a lot of trouble during boiling, as, owing to gravitation it settles down in the pan and hence cannot be removed along with the scum. This then imparts dark colour to *gul.*

In many places it is a custom to cut top sets and reserve them for planting. This improves the quality of the cane as the uppermost part of the cane which is unripe and contains a high amount of reducing sugars and albuminoids is eliminated and the resulting product will certainly be good in quality. This practice should therefore be followed wherever possible as this will serve two purposes, one of improving the quality of *gul* and the other of utilizing best part of the cane for planting which would germinate quickly and evenly. The top sets of the cane contain already available food required for germination of the buds.

3 *Period between cane cutting to boiling* :—

The sugar content of the cane begins to deteriorate rapidly after the stalks are cut and hence these should be conveyed to the mill as early as possible and crushed immediately. Many times canes are cut and remain exposed on the ground for a long time, which causes rapid deterioration resulting in the inversion of sucrose. If it becomes necessary to keep the canes for some hours or days on account of the breakdown of the crusher as sometimes happens, then they may be piled in the shade in a cool place and be covered with trash and water sprinkled two or three times daily. The point is not to allow the cane to dry. Because drying of cane causes the death of the cells. As long as the cells are alive, the composition of the cane does not undergo a great change but when once they die, deterioration sets in rapidly. By constant sprinkling of water the cane is kept moist and is not allowed to dry. As far as possible cane should be crushed as early as possible after it is cut to prevent deterioration. Normally if the cane is kept in the shade after cutting, it should be crushed within 24 hours after cutting. It should be remembered however that deterioration would be rapid in hot days.

4 *Method of boiling* :—Under this head there are five different things which should be carefully looked to,

(*a*) Period between crushing and starting of boiling.
(*b*) Clarification.
(*c*) Point of striking.
(*d*) Time occupied for boiling.
(*e*) Cooling.

(*a*) As soon as the juice is extracted, it is necessary to boil it immediately. Cane juice forms a very suitable medium for the development of micro-organisms which causes sourness, inversion and fermentation. These develop on the albuminoids that are dissolved in the juice and if the juice is boiled at once, these are coagulated and removed and further development of micro-organisms checked.

It becomes sometimes necessary to preserve the juice for some hours or a day or two in case the pan or furnace goes out of order or premonsoon showers fall which wet all the fuel and the boiling is necessarily required to be stopped. Under such circumstances a preservative should be used. Formaldehyde or formalin is very effective for this purpose. It must be remembered that formaldehyde is a poison and care should be taken that juice treated with this should not be allowed to be drunk or fed to cattle. However it practically evaporates from the juice in the evaporation as it has a lower boiling point than the juice so that this poison would no longer remain in the finished product. The formaldehyde available in the market is generally 40 per cent. strong and the quantities to preserve a normal juice are as below.—

To preserve juice for 1 day 1 part of formalin to 8000 parts of juice.
„ 2 days „ to 5000 „
„ 3 days „ to 3000 „

It has been found that by the use of this preservative there is not appreciable change in the composition of the juice. Formalin should be mixed thoroughly with the juice. It may after a time evaporate itself from the juice which may therefore be covered. Also it should not be added to hot juice as it would evaporate at once. Formalin is so cheap that it would be advisable to employ it in larger quantities than indicated above. If the juice has already undergone some fermentation, greater quantities of formaldehyde would be necessary which should be judged in each individual case.

(*b*) *Clarification* :—After the juice is got ready, it should be boiled. As the juice begins to get heated, albuminoids that are dissolved in the juice begin to coagulate and rise to the surface in the form of scum which should be carefully removed by the laddle. This removal of the scum is the most important operation in *gul* boiling which affects the quality of *gul*. Nearly 75 to 80 per cent. quality of *gul* would depend on the perfection with which the scum is removed. In fact it is the most potent factor in *gul* boiling. This operation requires a skilful man. Many of the complaints that are received from the mofussil are mostly due to this. If the scum is not removed at the right time, it remains mixed with the juice imparting permanently a dark colour to jaggery, the dark or green colour that is sometimes present in *gul* is mostly due to this imperfect clarification. Juice from unripe cane contains more albuminoid which requires greater care in skimming. Well clarifield juice can be boiled to a higher temperature than badly skimmed juice without affecting the colour.

Care is again necessary at the time of frothing in order that the juice may not run over. If any second scum appears it should be carefully removed. The removal of the second scum is not a difficult operation if the first scum is well removed.

(*c*) Point of striking:—When the juice attains a certain concentration, the pan is taken away from the fire and the massecuite is dumped into a cooling pan for cooling. This is ordinarily done by the *gulwas* by testing a little of the massecuite. This can be well managed by the use of a thermometer so that pans may be struck at a particular temperature (118°c). This temperature varies according to the altitude, the one at the sea level being 120°c. The striking temperature chiefly affects the hardness and colour of *gul*, because the higher the temperature at which the pan is struck, the harder will be *gul* (because more moisture will evaporate from the massecuite) and the deeper will be the colour. Pans struck at lower temperatures will yield a soft and at the same time light coloured *gul*.

(*d*) Time occupied for boiling:—The quality of *gul* will depend on the period that is required for boiling the juice. The longer the juice is boiled, the more the inversion which in turn makes soft *gul*. Hence it is always good to finish the boiling within as short a period as possible.

(*e*) After the pan is struck, the massecuite is cooled. During the time it is cooled, it is two or three times stirred. The time and amount of stirring of the cooling mass affects the size and amount of the crystals. If the mass is stirred for a long time, small crystals are formed and the *gul* becomes rather soft. If slow stirring is done, big crystals will be formed.

If the precautions detailed above are followed, a good quality of *gul* is ensured. So long the juice is normal, nothing is required to be added to the juice and good *gul* can be prepared. But many times the juice undergoes certain amount of fermentation, probably due either to lodging or overripening when it becomes necessary to add certain amount of lime, when the juice acids are formed, which are the chief cause of inversion. Some times this inversion is so much that it does not form solid *gul* and only a sticky dark product devoid of crystals is the result. In such cases use of lime is quite essential. It is alkaline in reaction and neutralizes the free acids of the juice, thus preventing inversion and ensuring formation of *gul*. Care is necessary to see that lime is not added in excess. When it is added in excess, it acts on the reducing sugars at a high temperature forming lime salts of the organic acids which are dark coloured and easily decompose to form acid substances which cause inversion of the sugar. If an excess of lime is therefore added, the *gul* becomes blackish and hence is not good. Lime just sufficient to neutralize the acidity should be added. It is not possible to give out exact quantity of lime that may be necessary as it will vary with the acidity of the juice. When adding lime, the point of neutrality may be determined by the use of a litmus paper. When once the acids are neutralized, further inversion would be stopped and a solid *gul* may be formed.

The above are the main points in the manufacture of *gul* which if followed will probably solve many of the difficulties that are felt at present and the progress of the *gul* manufacture will become a matter of easy and successful enterprize.

Student's Corner.

A Jack Fruit tree in Goa.

BY

C. Furtado.

CLOSE to my house in Goa, there is a jack fruit tree whose peculiarities attract attention, and if any method can be suggested for bringing it to a satisfactory condition, it will be certainly of considerable advantage. The whole stem of the plant is full of knobs and knots. At almost every knob a branch arises, and about the end of July every year these branches bear abundant buds. These buds, in course of time, form fruits, and the number of such fruits is very large indeed. But as soon as the fruits are a few inches long, they begin to fall, and not a single fruit matures and ripens. The matter is particularly unfortunate because otherwise the fruits would ripen early, much earlier than usual, and so would have fetched a particularly high price in the market.

Various remedies have been suggested. Some thought that the very large number of branches, most of which only lived a single year, was the cause of the evil, and suggested that only a few of the branches should be kept to bear fruits. Others said that the tree was in need of water and that it should be watered from February to May each year. Others declared that it had too much water. The crown, they argued, of a tamarind tree a few feet away prevented the evaporation from the soil, (whether of rain water or well water) and hence there was stagnant water in the soil and this was the cause of the evil. They prescribed drainage as the remedy. None of these suggested remedies have, however, been successful.

A partial cure has however been obtained and the story is interesting. Once the tree, to our surprise, bore three ripe large and sweet fruits, and though we were not able to explain it at the time, an explanation seems to have come later. Some time ago we decided to cut the tree down for timber, but on beginning the work, after making a big wound in the tree, the workmen said that the inner wood was too soft to be any use for timber, and the work was stopped. From the wound, however, a liquid began to ooze out, yellowish red in colour and putrifying after a short time. This continued for four months when the wound showed signs of healing, and the tree gave three good fruits that year. For the next two years it gave us no fruits so we cut a wound of about the same dimensions as the old wound (12″×9″×9″) and obtained the same result again. We have repeated the procedure on two further occasions, and again got good fruits, though the tree has never borne more than three in one year. In one case it only bore two good fruits.

I should be pleased for any further information on this matter and for any suggestions which will lead to better results.

Address to Dr. Harold H. Mann.

A meeting of the Students' Union of the Poona Agricultural College was held on Tuesday, the 4th February under the presidency of Prof. N. V. Kanitkar, to present an address to Dr. Harold Hart Mann, the late Principal of the Poona Agricultural College and the present Acting Director of Agriculture, Bombay, and to give a hearty welcome to Prof. J. B. Knight, the new Principal of the College.

The Secretary first read the address to Dr. Mann. In the course of the address it was stated :—

" You will kindly allow us to take this opportunity to pay you our humble and heartfelt tribute to your splendid work in Science, your earnest devotion to Indian Agriculture and Agricultural Education and your no less considerable social and philanthropic work. Your work in every one of these spheres has been thorough and wholehearted and will ever inspire your students to emulate you. Your zeal to spread agricultural education over the whole country, the privileges which your students enjoy and your sympathy towards them, have always drawn in students from all the corners of India—nay, even from the Federated Malay States, Burma and Ceylon. Although you have now ceased to be directly connected with the Poona Agricultural College, your great exertions, which have succeeded in bringing it to the front rank among the Colleges in the Bombay Presidency, will ever be remembred in connection with it and will enable it to maintain the position it has reached. We cannot but feel a keen sense of sorrow in losing in you a revered Principal and a thorough and excellent Professor ; but there is solace in the thought that you, when you leave us, will enter a wider field of work and will have greater opportunities to develop Indian Agriculture. Your sympathies are wide, but they seem more especially directed to the uplift of the depressed and the ennobling of the humble and your appointment to direct the Agricultural Department which from the Indian point of view, is in some sense the most important of departments, has created hopes which we feel no doubt, you have the strength and capacity to fulfil. We trust that long after you have departed from this College, you will continue to cherish the memory of your students and we assure you that your students in turn will ever be conscious of the great debt they owe to you."

Several students then spoke dwelling on Dr. Mann's virtues—his love for democracy, his sincerity in work, his freely mixing with the students and his paternal love and care for them, his solid work in the development of Indian Agriculture in general and Agricultural College in particular, his social work in the raising of the Depressed Classes, and in the cause of temperance, his work in the Bombay University, etc.

DR. MANN'S REPLY.

Dr. Mann in replying said :—" I have been asked to give some advice to the students, but I am afraid I have first got myself to clear of charges that have been levied against me. I want first of all to thank you for all the kindness and honour you have done me this night. I thank you for the kind address you have given me ; and I thank you for the beautiful casket you have presented to me. I do not know if the Government will allow me to keep it. (Cries of " No, No, it cannot refuse.") Well, if the Government does allow me, I shall certainly cherish it and preserve it for all the rest of my life.

" Gentlemen, most of the charges brought against me are true—I might say, unfortunately true. I have been shown to be a hard master. Perhaps I have been so. I am very sorry if I have been so. I do not want to be very hard on any body ; but then I do want to be hard on myself. And I want you also to be very hard on yourselves. I should be very sorry if I did not use every bit of energy, every atom of strength I have, to realize whatever little I know ; and I want you, gentlemen, to utilize every ounce of energy you possess, the very last ounce of strength you may have to realize what you know or learn (Cheers).

" Gentlemen, the future of Agriculture of India lies in your hands, more than in the hands of any body else (Hear, Hear). It depends on you ; it depends on the graduates that have been, and the graduates that will be. (Cheers). This reminds me of a German Professor who always used to bow to his students. On his colleagues asking him the reason of this, he said, " Gentlemen, I am bowing to my students, not for what they are, but for what they shall be." So when I say that the future of Indian Agriculture lies in your hands, I am not thinking of what you are, but of what you shall be. (Hear, Hear).

"Gentlemen, when I came to India in the year 1900, I saw a bright vision wherein I saw a very glorious furture for India. I have maintained my firm belief in the truth of that vision to this day; and I am sure, from my experience during the last eleven years, it can never be shaken off. (Hear, hear). I saw in that vision that the condition of the Indian cultivators could be improved very rapidly, that the people now incumbered in debts could live a prosperous life, (hear, hear) that the soil of India could produce crops to compete with any other nation in the world. (Hear, hear, and loud cheers). I was then in Assam and working there with a commercial body like the Tea Planters' Association. I had no means to realize what I saw in my vision. But as soon as I got the Principalship of this College, I took the opportunity to realize the force of my vision. It is eleven years now; and I have passed the very best time of my life in this college. I came here at 35, and I am 46 now.

"My vision is not as yet fully realized. I have still got to work for the realization of my vision. But I believe every one of you can do much more than I have done (Hear, hear). I look upon the graduates of this college to help me in this realization (Cheers). You can do for India much more than any one else can. (Hear, hear, and loud cheers). But, gentlemen, I do not want you to get conceited—God knows I do not. (Cheers). At the same time I do want you to see the importance of realizing what you learn. If you, may I say once again, utilize every atom of your energy, every ounce of your strength, and every bit of your capabilities in the realization of this vision, you shall have done your duty and I shall have been sufficiently paid for what little I may have done for this college.

"Gentlemen, I do not want to say anything beyond this; but I want to thank you once again for all your kindness this night. I thank you for all you have been to me, for all you have done to me, and for all you have said to me this night."

PROF. KNIGHT'S REMARKS.

Next Prof. Knight said :—"I have been placed in very awkward position when I have to follow Dr. Mann both as a speaker to night and as the Principal of this college. In succeeding Dr. Mann I shall have to satisfy people who will make a sort of comparative study and measure me with such a measure as Dr. Mann; and I shall undoubtedly fall short, for the measure is too big.

" Gentlemen, I came here on mission work having been moved by the account of repeated famines and poor condition of cultivators in India, given to us in our college by a missionary. I started my work at Ahmednagar on a salary of Rs. 120 per mensem. The mission did not turn out to be a success, and I had actually booked my passage home when Mr. Lawrence, the then Director of Agriculture, offered to me the post of the Professor of Agriculture in the Engineering College. I soon proposed that the Agricultural branch should be made a separate institution. The proposal was carried and the grounds were purchased. Gentlemen, I had the ambition to be the Principal of the college ; but I soon learnt that Dr. Mann had been given the post. I remember the exact words I then used. I said, " In my loss lies India's gain."

" We pulled on nicely for these eleven years, with but a few differences, for no two natures are alike. Gentlemen, when I last went to America, I went tired of India, and tired of this college. But after I had passed a year there, I felt a sort of longing for India. On some of my friends asking the reason of my return, I took a little address that had been presented to me by the students ; and I said, " This is what makes me go. (Hear, hear). I am fond of working in the districts ; and I was thinking of exchanging my post for some time with Mr. P. C. Patil, the Deputy Director, when the Director told me of my appointment to the Principalship. I did not seek it now, but I got it.

" Now, gentlemen, all that I have to tell you is that I promise to do all I can for the uplift of agriculture in India (Cheers), and welfare of this college (Hear, hear), no matter whether I am in this college or in the districts or anywere else, (Cheers). I shall use all my energy and strength to improve Indian Agriculture (Cheers) ; and if I fail to do much, it will not be that I shall be sparing any energy on my part, but because I shall not be capable of doing further." (Cheers).

Next the chairman made a few remarks, dealing with the splendid work that Dr. Mann and Prof. Knight had done in the building of Indian Agriculture. He fervently hoped that Dr. Mann would continue his interests in the college and Prof. Knight would follow in the footsteps of his illustrious predecessor.

Three cheers being raised for Mrs. Mann, Mrs. Knight, Dr. Mann, Prof. Knight, other guests, and the Agricultural College, the meeting dissolved.

The College Geological Tour 1918.

BY

C. X. Furtado.

LEAVING Poona on December 13th, the first stop we made was at Londa, on the Southern Maratha Railway in the heart of the great forest of the South Western portion of the Bombay Presidency. Almost the whole of the next day was spent in the Londa forest. To most of our students, wandering in dense jungle, with no guide but a compass appears somewhat romantic. But the experience is required to appreciate thoroughly the enjoyment. It was exceedingly pleasing to see the large company of pioneers creeping along between the vegetation and the only ones who suffered from the thorny and other bushes were those who wished to walk with head erect. Without leaving our course, we had many opportunities to examine the geological characters of this district, and very interesting we found them, while the interest was maintained by other things which constantly came before our eyes.

After leaving Londa, the next stop was at Castle Rock. From this place, which we reached in the darkness of the early morning, we set off on foot to Dudhsagar Falls, eight miles away following the track of the railway down the Braganza *ghat*. Though the road was rather trying, the scenery was exceedingly charming, and the geological interest of the tramp was very great indeed. The view over the Goa territory caused many inquiries, and many of the party there and then decided to visit Goa, my own country, during the May or October holidays. It is no wonder that this was particularly felt by those who were natives of dreary places like Poona. After a refreshing bath at the glorious Dudhsagar falls, we returned by train to Castle Rock, and so off to our next stop at Gokak.

At Gokak we began with trouble. The cook of the Cosmopolitan club to which I belonged fell ill, and had to be packed off to Poona. As a result we cooked for ourselves with fair success. We visited the town, the mills, and in addition, we were able to pick up many minerals of great value. After a photograph by Messrs. Mahadev and Co. of Belgaum who visited Gokak for the purpose of taking it, we left for Kundal Road to pay a visit to Messrs.

Kirloskar Brothers' at Kirloskarwadi. These works, where we were liberally entertained by the proprietors, are really the first Agricultural Implement Works in Western India. Other firms have made agricultural implements: Messrs. Kirloskar Bros. have specialised in this direction. In the village attached to these works, the first thing that struck us was the happy faces of the workmen, and it would appear that the secret of the success of the proprietors lies chiefly in the fact that they take a great interest in the welfare of their people. There is not a single European on the spot, all are Indians from the managers to the lowest menial. There is a Marathi school where free education is given, and all castes and creeds are treated exactly in the same fashion. Merit seemed the one reason for advancement both in the works and in the schools at Kirloskarwadi. Each house has a garden, roads are well laid out, the shops on the place are co-operative, games are encouraged and are provided for, and even a small cinematograph house has been erected. We were much impressed by all these arrangements which seemed to make a more ideal village than any we had ever seen.

From Kundal Road we returned to Poona feeling the tour had been all too short. We were unfortunate in not being able to visit as many places as usual, but we enjoyed it beyond our expectations, and from the geological point of view, the knowledge gathered is, I am almost sure, at least as great as in the longer trips of our lucky predecessors. On the geological aspects of the country we passed through, I need not dilate. It has been fully described in former accounts of tours through the same areas. But we have to thank all those whom we met for their kindness, and to wish our successors a still better time and a longer tour than we were permitted to enjoy.

A Prize Essay.

——:o:——

1. A prize of Rs. 30 will be awarded to the best Essay on 'The Indigenous Ploughs in the Bombay Presidency,' in accordance with the following conditions:

2. Competitors shall be Agricultural Graduates of the University of Bombay or Diplomates of the Poona Agricultural College.

3. Competitive Essays should be written in English and should be sent to the Secretaries, Bombay Agricultural Graduates' Association (Agricultural College, Poona) before the 1st of January 1900. Each Essay should be designated with a motto instead of the writer's name and should be accompanied by a sealed cover containing the motto and the name of the competitor.

4. The Essay should specially deal with (*a*) the mechanism of the various ploughs in the Bombay Presidency, (*b*) the purpose for which each is specially constructed and (*c*) the possibilities of improvements in the indigenous ploughs.

5. The Essay will be submitted to a committee of Judges whose decision will be final.

6. No prize will be awarded to an Essay which, in the opinion of the Judges, is not deserving of a prize.

7. The Essay to which the prize will be awarded will be the property of 'the Bombay Agricultural Graduates' Association'.

Gymkhana Notes.

A meeting of the General Body of our College was held on the 12th of February 1919 when the following office-beares were duly elected to form the Gymkhana Committee for the year 1919 20:—

General Secertary	Mr. N. G. Gole.
Tennis Dept.	,, Panjabi.
Cricket ,,	,, D'Arcot.
Football,,	,, Khin Maung.
Debating Society	,, Phadake
Gymnasium	,, Jog.
Senior Manager College magazine.	,, G. B. Shinde.
Junior Manager	,, Ayanna.
Reading Room	,, Canak Ratnam.

We congratulate these gentlemen and also the General Body for the the excellent choice it has made. We can not resist the temptation of heartily congratulating Mr. N. G. Gole for his being elected the G. S. of our Gymkhana almost unanimously. We know no student who is better suited to this post than Mr. Gole. It is not too much therefore to hope much better work from him than in the past. Before we leave this point, we have to thank the outgoing Secretary—Mr. C. M. Bhat. We only hope that Mr. N. G. Gole will spare no energy to make his career a successful one and that his co-workers will always be ready to help him in his responsible task.

This year had been a trying one to our College Gymkhana; the sports that could not be held at the time of our Social Gathering, took place in the earlier half of February. We are glad that the sports were lively, many students taking interest in them. No doubt, there was not as keen a competition as it was in the last year; but we think it was due to the awkward time rather than to any inherent lack of sportsmanship in the students themselves. The prize distribution ceremony was done by our most sympathetic Principal, Prof. Knight, who spoke encouragingly to students and assured them that he would always try not to loose sight of the physical development of students.

Most important among the prizes, were those for Championship, Tennis, Cricket and for Public-Spirit. We are glad that our last year's champion—Mr. Jog—has again been declared as a champion this year also. We have a right to rejoice at his double success and we most heartily congratulate him upon this high honour.

Mr. N. G. Gole won, in addition to the Tennis medal, the Ahamed Mann Medal for polularity. Mr. Chaugule won a medal in Tennis doubles. Mr. D'Arcot is a fine cricketeer of our College and is therefore awarded a medal for his proficiency in Cricket; he also gets the popularity medal. Mr. Shinde is a fine bowler and gets a medal. We most heartily offer our congratulations to these students.

Last but not the least, we feel it our duty to offer our congratulations to our Ceylon friend Mr. Raghunathan who is in Senior B. Ag. We are glad that he has won over the hearts of his fellow students and has been very popular among both the staff and students; he got the popularity medal.

College News & Notes.

WE have great pleasure in informing our readers that Messrs. Rajdeo and Prayag have been honoured with the M. Ag. degree this year. We are proud that the two gentlemen are the past students of our College and have been the first in getting the highest honour in agriculture in the land. Mr. Rajdeo got his degree on the thesis that he wrote on "Salt Lands of Hyderabad" and Mr. Prayag, who is well known for his researches on "Mango" got the degree by writing a thesis on the work.

We most heartily congralulate both the gentlemen upon their success and honour and hope we shall have many more occasions of offering our heart-felt congratulations to others who, we have no doubt, will follow.

Our readers will feel pleasure to hear that Messrs. S. R. Godbole, Chitale, Joshi and Dani who are the graduates of this College, have come out successful in their Inter-Science examination. We could not have been the least astonished if by going through the B. Ag. Course in this College, the above gentlemen had stood high in the 1st year Science examination. We congratulate the above gentlemen upon their success.

We are glad that we got our fine College Buildings back again; we gave up the Building with unmixed joy, and have a right to receive them back again with great pride. "Agriculture" had helped to win the European war in many a ways and the contribution of the Agricultural College Buildings, Poona for winning over the war will stand as the highest honour to all those who are concerned with our College. Our hearts froth with joy to see our Buildings back in our hands. The present Senior B. Ags. are indeed, unfortunate enough not to be able to enjoy the finest residency in western India; but it is our deliberate convinction that they have always looked upon the sacrifice that they have undergone, as a source of great pride and pleasure.

We, here, print a letter that was received by our Principal from the Authorities of the Deccan War Hospital, that will speak of itself.

31 Burr Road,
Kirkee, 14th April 1919.

THE PRINCIPAL,
Agricultural College, Poona.

DEAR SIR,

The Deccan British War Hospital has now ceased to exist and I wish to convey my sincere thanks for the kindness and courtesy I have received from you and your staff ever since I came here in May 1916 and can assure you it was a very great help to me in organising the Deccan War Hospital. I am of course very sorry to part with the Hospital but you may rest assured that now it is an accomplished fact, I am extremely glad that you have got back your old home again and I have always sympathies with you for our unavoidable occupation of your very fine College. Again thanking you and all.

Believe me,
Yours sincerely,
(Sd.) H. WINTER,
Lt. Colonel, R. A. M. C.

I. A. R. I. 75.

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